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MILLER (L. W.). **The Insect Pests of Tomatoes.**—*Tasm. J. Agric.* **16** no. 4 pp. 144–148, 4 figs. Hobart, 1945.

Brief notes are given on the bionomics and control of the principal pests of tomato in Tasmania. They comprise *Heliothis armigera*, Hb., *Gnorimoschema operculella*, Zell., cutworms, *Listroderes obliquus*, Gylh., Aphids, and, in glasshouses, *Trialeurodes vaporariorum*, Westw., and *Phyllocoptes lycopersici*, Massee. *Thrips tabaci*, Lind., is of importance as a vector of the spotted wilt disease [*Lethum australiense* var. *typicum* of Holmes].

HOFFMANN (A.). **Sur des dégâts occasionnés par** *Otiorrhynchus ligustici* **L. dans des cultures potagères à Chevilly (Seine).**—*Cah. Path. vég. Ent. agric.* 1942 pp. 8–9. Paris, 1942.

A severe outbreak of *Otiorrhynchus ligustici*, L., occurred in a market garden near Paris in April 1942. The weevils fed first on strawberry and then on peas, broad beans, sorrel [*Rumex acetosa*], and iris, but did not attack other plants, including various vegetables. The distribution of the infestation indicated that it had originated in an area that had been under lucerne in 1940; it was under potatoes in 1941 and fallow in 1942, and the weevils presumably migrated from it during these years, following the removal of their preferred food-plant.

PUSSARD (R.). **Sur une pullulation d'***Orphania scutata* **Br. (Orthoptère-Phasgonuridae) dans les Alpes-maritimes.**—*Cah. Path. vég. Ent. agric.* 1942 pp. 16–24, 9 refs. Paris, 1942.

In 1939, an outbreak of *Orphania scutata*, Br., occurred at Séranon, near Grasse (Alpes-Maritimes) at an altitude of nearly 3,600 ft. This Tettigoniid had hitherto been recorded only from the Departments of Basses-Alpes and Gard in France and from Serbia, but has been known to the villagers of Séranon for over 40 years. The eggs are laid over an area about one mile by rather less than ½ mile in extent in damp natural meadows in a mountain valley, and in 1939 the hoppers appeared in numbers at the beginning of April in the wettest meadows by a stream-side. They mostly attacked the shoots of leguminous forage plants, almost all of which were damaged by them in June, when they were in the last instar. The adults, which appeared and began to pair at the end of June and the beginning of July, were abundant on the leguminous plants until the meadows were mown during July, and then attacked neighbouring crops, including potato, beet, carrot and wheat, but did not cross slight obstacles, such as a road. They disappeared during the first half of August. Under experimental conditions, both nymphs and adults fed on plants of many different kinds, and the females laid their eggs in batches surrounded by particles of soil. A careful search for eggs in the meadows was made on 7th August, and several isolated ones were found at a depth of about ½–¾ in. The eggs are very sensitive to desiccation, which may in part account for the local distribution of the species. They hatch in the following spring.

All the adults taken in 1939 differed slightly from the typical form in being marked with black and resembled some reared from hoppers collected by Azam at Col de Valgelage (Basses-Alpes) in 1909; they are considered to represent a variety, which is named var. *azami*, n. There was no evidence that this melanism was due to high temperature, and it could not be associated with swarming, since no gregarious habit was noted in *O. scutata* var. *azami* in 1939 [*cf.* also *R.A.E.*, A **14** 183], and in 1941, when there was no outbreak, most of a collection of 36 adults were melanic.

A bait of bran, molasses and sodium arsenite applied to a very small area in mid-June gave some mortality, but it would be better to apply it in May so as

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to prevent much of the damage caused by the hoppers and reduce the risk of poisoning sheep that feed in the meadows after the hay is cut. Other possible measures comprise draining the meadows to provide soil conditions unfavourable for the eggs and spraying potatoes with an arsenical just before the meadows are mown.

PUSSARD (R.). **Quelques années d'efforts pour développer la production fruitière dans la haute vallée du Verdon.**—*Cah. Path. vég. Ent. agric.* 1942 pp. 25–33, 2 refs. Paris, 1942.

Observations by the author in 1936 suggested that failures of the apple crop in the Basses-Alpes, particularly the valley of the Verdon, which had been attributed to climatic changes and had led to the general abandonment of the orchards, was due to heavy infestation by insects and fungi. The chief insect pests of apple in the district are *Hyponomeuta* [*padellus malinellus*, Zell.], *Anthophila* (*Simaethis*) *pariana*, Cl., *Operophtera* (*Cheimatobia*) [*brumata*, L.], *Cydia* (*Carpocapsa*) [*pomonella*, L.], *Rhynchites bacchus*, L., *Anthonomus pomorum*, L., and *Psylla mali*, Schm., and the fungi are scab [*Venturia inaequalis*] and *Monilia cinerea*. At his suggestion, a full schedule of winter and spring treatments was carried out in one such orchard in 1937, and a yield of over 2,200 lb. high-quality fruit was obtained from 20 trees. No fertilisers or cultural measures were employed, but in an attempt begun in 1938 to bring into bearing an orchard of 100 trees from which no crop had been obtained for many years, a manurial programme was adopted and colonies of bees established in addition to the application of insecticidal and fungicidal sprays by power equipment. As a result, the yields of high-quality fruit increased from 0 in 1938 to 9,240 lb. in 1941. Recommendations for control measures to suit local conditions are given. Those directed against insects comprise the use of adhesive bands on the trees from October to trap females of *Operophtera*, spraying with 8–10 per cent. emulsified tar distillate in Bordeaux mixture [*cf. R.A.E.*, A **35** 70] in March or at the beginning of April, two applications of an arsenical in Bordeaux mixture, the first at the end of April or during the first fortnight of May against leaf-eating caterpillars and *Anthonomus*, and the second at the end of June or the beginning of July against *Cydia*, and the use of bands of corrugated cardboard between June and November to trap larvae of *Cydia* and adults of *Rhynchites bacchus* seeking winter quarters.

The observations showed that *R. bacchus*, which was very abundant in 1939 and 1941, is the most important pest of apple in the locality and destroys or injures 60–70 per cent. of the fruits. The larvae usually overwinter in the soil, but in heavily infested orchards many overwinter in mummified fruits attacked by *Monilia cinerea* that remain on the trees and such fruits should be collected and destroyed. A few of the larvae remain in diapause for two winters. The adults are readily controlled by nicotine sprays, which can be used to supplement the trap bands. *C. pomonella* has only one generation a year in this area, and infestation at harvest can be reduced to 2 per cent. by a single application of an arsenical spray in June or July.

GRISON (P.) & COUTURIER (A.). **Sur les générations de *Leptinotarsa decemlineata* Say dans le Bordelais en 1942.**—*Cah. Path. vég. Ent. agric.* 1942 pp. 38–41, 2 refs. Paris, 1942.

As *Leptinotarsa decemlineata*, Say, occurs on potato in the Bordeaux district from May until early autumn, all stages are present for more than four months, and development occupies an average of 35 days, there appear to be overlapping generations. It has been shown, however, that there is no effective second generation in central France, where, owing to climatic conditions, the adults

appear later and development is more protracted [*R.A.E.*, A **33** 158]. An attempt was therefore made in 1942 to separate the influence of climatic and agricultural factors from that of specific biological factors in determining the number of generations that develop each year at Bordeaux. Observations indicated that overwintered adults present between 26th May and 23rd June laid considerably more eggs than first-generation adults, which appeared after the latter date. In a test in which ten pairs of overwintered adults that had been kept at a temperature of 14°C. [57·2°F.] with limited food to reduce their activity and ten pairs of first-generation adults were caged with potato plants in the field on 15th July, the overwintered beetles deposited 900 eggs between 30th July and 20th August, and seven of them entered the soil to overwinter a second time ; 17 of the first-generation adults had entered the soil for hibernation by 10th August, and none of them oviposited, although eggs were laid by other first-generation females that were kept in the laboratory under optimum conditions. It is therefore concluded that only one generation occurred in the field in 1942, although plant growth was favourable, and that the eggs and larvae that are present in July–September are the offspring chiefly of overwintered females that emerge late from hibernation or cease ovipositing for a time.

WISHART (G.). *Aplomya caesar* (**Aldrich**), **a Tachinid Parasite of the European Corn Borer.**—*Canad. Ent.* **77** no. 9 pp. 157–167, 14 figs., 12 refs. Guelph, Ont., 1946.

Pyrausta nubilalis, Hb., is regularly attacked by only two indigenous parasites in Canada, *Labrorychus prismaticus*, Nort., and *Zenillia* (*Aplomya*) *caesar*, Aldr. The latter is the more abundant, and an account of its distribution and adult morphology is quoted from a paper by Sellers [*R.A.E.*, A **31** 445]. Sellers considered that the Tachinid described by Townsend as *Exorista nigripalpis*, which is a preoccupied name, is identical with *Z. caesar* [or possibly with *Z.* (*A.*) *confusionis*, Sellers, records of *E. nigripalpis* as a parasite of *Crambus* spp. in the United States (**11** 490 ; **16** 209) referring to *Z. confusionis*, and those of it as a parasite of other Lepidoptera, including *Pyrausta nubilalis* (**7** 481 ; **10** 482 ; **11** 499 ; **12** 177) and *Tortrix* (*Archips*) *argyrospila*, Wlk. (**1** 226 ; **11** 208) to *Z. caesar*]. A list of the hosts of *Z. caesar* is given, and the egg, three larval instars, and the adult reproductive organs are described. Parasitism of *P. nubilalis* by it has in general markedly increased in Canada since it was first observed, but varies from year to year and has ranged from less than 1 to as much as 26 per cent. at one place in eastern Ontario in 1941. These fluctuations are not correlated with the abundance of *P. nubilalis*, and are probably due to changes in the abundance of its other preferred hosts. It has been obtained from *P. nubilalis* in all the areas in southern Ontario and southern Quebec in which the latter is of importance as a pest.

In cage observations in 1933 and 1942, adult emergence continued from late May to 1st July, with a peak during the first ten days of June. Females survived for more than 40 days in the laboratory, and as larvae of *P. nubilalis* are abundant by mid-July, the parasite can possibly maintain itself on this host alone ; other hosts may be attacked earlier in the season. It normally has one generation a year in *P. nubilalis* in Ontario and Quebec, but a few fresh puparia were found in July on maize growing in Essex County, Ontario, where *P. nubilalis* produces a partial second generation [*cf.* **33** 138] and in such cases the parasite will also pass through two generations. Under cage conditions, the females mated most readily within 2–3 days of emergence and the males when several days old ; at 75°F., oviposition began not sooner than eight days after mating. The females laid their eggs on freshly-cut surfaces of *Rumex crispus*, green beans or maize, but these were much more attractive if they had first been attacked by larvae of *P. nubilalis* ; in the field, most eggs are probably laid where the host larvae are feeding. Oviposition continued for 3–4 weeks,

most eggs being laid during the first week ; each female matures about 1,000 eggs. The parasite egg is ingested by the host larva with its food, and hatching, which is described in detail, and the subsequent movements of the parasite within the host were studied in the laboratory in larvae that had been fed on green beans and were consequently somewhat transparent. The parasite larva usually hatched in less than one hour in the fore-gut or in the anterior part of the mid-gut and immediately entered the body cavity. It moved to the head and took up a position between the adductor muscles of the mandibles within a few hours. Where there is only one generation of *P. nubilalis* a year, the parasite overwinters as a first-instar larva in the head of the host, but when the hosts were kept at a constant temperature of 80°F., a proportion of the parasites, roughly corresponding to the proportion of hosts that pupate without diapause if unparasitised, completed their development without a diapause. The tendency of the parasite to diapause appears, therefore, to be determined by that of the host. On leaving diapause, the parasite larva cut a respiratory opening at an antennal sclerite and a respiratory funnel was formed at this point. It moulted 24–48 hours later and again after a further 36 hours. It then fed actively on the thoracic and abdominal organs of the host and became fully grown and left the host through the ventral surface of the abdomen 6–8 days after the breaking of diapause. A puparium was formed almost immediately, and the adult parasite emerged after a pupal period of eight days.

SLATE (G. L.), SUIT (R. F.) & MUNDINGER (F. G.). **Raspberry Growing in New York : Culture, Disease and Insects.**—*Circ. N.Y. agric. Exp. Sta.* no. 153 (revd.), 64 pp., 17 figs. Geneva, N.Y., 1945.

This revision of a circular already noticed [*R.A.E.*, A **30** 54–56] contains, in addition to the previous information, notes on the bionomics and control of two additional insect pests of raspberry in New York State and further recommendations for the control of *Agrilus ruficollis*, F., *Oberea bimaculata*, Ol., and *Byturus rubi*, Barber (*unicolor*, auct.). The additional pests are *Agrilus rubicola*, Abeille, a Buprestid with a life-history similar to that of *A. ruficollis* [*cf.* **30** 55, 257], and *Pennisetia* (*Bembecia*) *marginata*, Harr. The larvae of this Aegeriid, which weaken and kill the bush by boring in the roots and crown of the canes, overwinter twice and pupate, usually in an old stub, during August. Adults are present until late September, and eggs are laid near the edges of the under sides of the leaves. Preventive measures include the destruction of dying or infested canes and killing larvae present in the crown by probing with a piece of wire. Old stubs should be broken over and crushed in May or June to kill any larvae or pupae in them, and wild brambles should be eliminated.

Insecticides are recommended for the control of the two species of *Agrilus* [*cf.* **30** 257–258] and *O. bimaculata* [*cf.* **30** 571], and it is stated that a spray of 3–5 lb. derris or cubé containing 4–5 per cent. rotenone with ½–1 lb. casein or powdered skim milk per 100 U.S. gals. or a 1 per cent. rotenone dust is effective against the adults of *B. rubi*.

LEWIS (H. C.). **Spray Injury from Zinc-Lime Sulfur in central California.**—*Calif. Citrogr.* **31** no. 4 p. 112, 1 fig. Los Angeles, Calif., 1946.

Orange trees in central California are commonly sprayed with 2 per cent. lime-sulphur in spring against the citrus thrips [*Scirtothrips citri*, Moult.] and the citricola scale [*Coccus pseudomagnoliarum*, Kuw.], and in recent years, zinc oxide, which is chemically compatible with lime-sulphur and does not reduce the insecticidal value of the spray, has been added for mottle-leaf correction. It was assumed that the combined spray would cause no more plant injury than lime-sulphur alone, but the fresh crops of oranges in orchards sprayed after petal-fall with 2 per cent. lime-sulphur combined with 1 lb. zinc. oxide,

4–5 lb. wettable sulphur and ½–¾ lb. casein spreader per 100 U.S. gals. have recently shown signs of injury. This has been less severe than the scorching often caused by spraying with lime-sulphur in hot weather and consists in irregular scars or scratches on the fruit, which sometimes lead to a reduction in grade. It occurs during cool weather and may be influenced by humidity. It has sometimes been confused with thrips scarring, but in 1945 it was suggested that the zinc oxide might be responsible and field trials were made. A spray of 2 U.S. gals. lime-sulphur, 5 lb. wettable sulphur and 8 oz. casein spreader per 100 U.S. gals., alone or with various quantities of zinc oxide or zinc sulphate, was applied to orange trees late in May, when the fruits were about as big as cherries, and the fruits were graded just before picking. The percentages reduced in grade were 6 for the spray without zinc, which caused slight scratching, 13 and 35 for sprays containing 1 and 2 lb. zinc oxide, 15 for sprays containing normal dosages of 2½ or 3½ lb. zinc sulphate, and only 0·5 for one containing 7 lb. zinc sulphate. This high dosage of zinc sulphate was apparently sufficient to neutralise enough of the lime-sulphur to make the combination safe (4 lb. zinc sulphate reacts chemically to neutralise about 1 U.S. gal. lime-sulphur), and the spray still gave good thrips control [*cf. R.A.E.*, A **29** 296]. A similar formula was used in southern California in 1937–39, mostly on lemons, and gave thrips control equal to that of lime-sulphur, quick correction of mottle-leaf, and no scorching of fruit or foliage even when used at high temperatures. This dosage of zinc sulphate should therefore be substituted for zinc oxide in sprays of lime-sulphur applied after petal-fall in central California.

PICKLES (A.). **Field Trials of Insecticides for the Control of the Sugarcane Froghopper.**—*Trop. Agriculture* **23** no. 1 pp. 9–11, 4 pls. Trinidad, B.W.I., 1946.

In view of the inconsistent results obtained by dusting with pyrethrum for the control of the froghopper [*Tomaspis saccharina*, Dist.] on sugar-cane in Trinidad [*cf. R.A.E.*, A **30** 495], field tests were carried out there in July 1945 with DDT and a proprietary sabadilla dust, both mixed with sulphur and applied by the drift-dusting method by means of a tractor-operated machine [*cf.* **29** 52], at the rate of 20 lb. mixed dust per acre. Counts of adult froghoppers before and after treatment showed that 1 or 2 per cent. DDT in sulphur caused considerable mortality on the windward side of the field but little or none on the side furthest from the line of application, where the population continued to increase. Much better results were given by 4 per cent. DDT, which caused a significant reduction in infestation 14 hours after dusting, and a progressive decrease for a period of five days throughout the field, despite the fact that adults were emerging daily and infestation in adjacent untreated fields continued to increase. After this, the population increased slightly, but not to such a degree as to cause economic injury. A dust of 30 per cent. sabadilla in sulphur gave results equal to those obtained with 4 per cent. DDT ; it caused high mortality after 14 hours, and as the population remained at a low level for about ten days, it was concluded that this insecticide possesses some residual effect. A mixture of 30 per cent. sabadilla and 4 per cent. DDT in sulphur was applied to half of a heavily infested field on one day and to the other half on the next, and a significant mortality occurred over the entire field after the second application.

In a discussion of the results, the author concludes that DDT at not less than 4 per cent., sabadilla at 30 per cent., and mixtures of the two are capable of reducing the froghopper population from 30–50 adults per stool to a level at which economic injury does not take place. Nevertheless, if populations are increasing rapidly at the time of treatment, a single application is unlikely to prevent them from rising to injurious levels. When DDT was used alone or with sabadilla, infestation continued to decline for some days after the treatment,

but when sabadilla was used alone, the maximum effect was obtained on the next day ; it is therefore concluded that while both insecticides show considerable promise for froghopper control, the residual effects of DDT are likely to make it a valuable addition to other substances giving more rapid knock-down.

SILVA (P.). **A " formiga de enxêrto ".** [*Azteca paraensis* var. *bondari*.]—*Bol. Divulg. Inst. Cacau Bahia* no. 1, 15 pp., 6 pls. Bahia, 1945.

A popular account is given of the way in which *Azteca paraensis* var. *bondari*, Borgm., injures cacao trees in the State of Bahia, Brazil [*cf. R.A.E.*, A **19** 117] and of its control by collecting and burning its nests. During 1944, over 12,000 nests were so destroyed, and a campaign for the eradication of the ant from cacao plantations was to be initiated.

STUBBINGS (W. A. K.) & HATTINGH (C. C.). **Control of Codling Moth in Apricots by Spraying.**—*Fmg in S. Afr.* **20** no. 231 pp. 369–372, 384, 1 ref. Pretoria, 1945.

Cydia pomonella, L., has been known for many years as a pest of apricots in the Wellington district of western Cape Province [*cf. R.A.E.*, A **13** 526 ; **15** 20], but although infestation has become more widespread there and at Tulbagh, it has not risen much in intensity, averaging about 35 per cent. in 1943 and 1944. Since canners do not accept apricots of which more than 5 per cent. are infested, interest in control measures has recently increased. A few growers apply hessian bands to the trees at the beginning of November, but they are of value only on young, smooth-barked trees, since it is not practicable to remove the old bark from the trunks and branches and fill in crevices on old trees [*cf.* **15** 20]. Spraying with lead arsenate is effective but injures the trees [*cf.* **15** 20], though basic lead arsenate is used to some extent at Tulbagh.

Preliminary experiments with sprays of fixed nicotine were carried out at Wellington in 1943 on apricot trees of a mid-season variety that were heavily infested in the previous year. The preparation used contained 5 per cent. nicotine and was applied at a concentration of 8 lb. per 100 gals. on 30th September, 12th and 27th October and 3rd November. Picking was in progress in the first half of December, and records of the crop and fallen fruits showed that the percentages infested averaged 2·2 for trees that received all four applications, 9 for those that received the second only, 2·6 for those that received the second and third, and 2·9 for those that received the third and fourth, as compared with 11·6 for no treatment. The critical spraying date thus appeared to be about 27th October, but adult emergence was late, and no eggs and only a few empty pupal cases were found at the time of the first application. A trial on a larger scale was made in 1944, when the trees flowered about a week later, the moths emerged a week earlier, and the larvae were unable to enter the fruit until after 26th October, owing to exudation of gum, though they caused superficial injuries. Fixed nicotine (14 per cent.) was applied at 3 lb. per 80 gals. and the spraying dates were 6th and 26th October and 6th and 16th November. Records were kept from 1st to 27th November, when harvest was complete. The percentages of fruits infested and superficially injured in the picked crop averaged, respectively, 1·4 and 8·2 for all four applications, 1·8 and 9 when the last was omitted, 6·2 and 17 for the first and third, 4·1 and 17·1 for the second and third, 3·8 and 10·8 for the first and second, 9·2 and 23·2 for the third and fourth, and 3 and 18·7 for the last three, as compared with 15·6 and 18·4 for no treatment. The differences required for significance were 4·3 and 5·9, respectively. The percentages of fallen fruits infested were somewhat higher in each case. The application made on 27th October was thus again the most important. No spray injury was observed in either year.

On the basis of these investigations, two or three applications of fixed nicotine at intervals of ten days, beginning about mid-October, are recommended. The third application is necessary only on old trees that have been heavily infested for a number of years, and early varieties should receive an additional application about the end of the first week of October. Trees capable of bearing 60 lb. of fruit should each receive about 2½ gals. spray where power equipment and a fine nozzle are employed. The cost of spraying is discussed and is shown to be economically justified. Infestation was reduced from about 50 to less than 5 per cent. in two other areas in which growers applied three sprays in 1944, but operations at Wellington are hampered by lack of equipment and scarcity of water near the orchards.

NEUWEILER (E.). **Bericht über die Tätigkeit der Eidg. Landwirtschaftlichen Versuchsanstalt Zürich—Oerlikon für die Jahre 1938 bis 1942. VI. Pflanzenschutz. (1. Januar 1939 bis 31. Dezember 1942.)** [Report of the Agricultural Experiment Station Zürich–Oerlikon for 1938–42. VI. Plant Protection. 1st January 1939 to 31st December 1942.]—*Landw. Jb. Schweiz* **58** pt. 4 pp. 404–414. Berne, 1944.

This report of investigations in Switzerland in 1939–42 includes a table showing the pests observed on various crops and their relative frequency in each of the four years and notes on the spread of *Leptinotarsa decemlineata*, Say, on potato from 1937 to 1942 [*cf.* also *R.A.E.*, A **34** 327]. In laboratory and field tests in 1941 and 1942, good results against both larvae and adults of this beetle were given by sprays of 1·25 per cent. lead arsenate, 0·4 per cent. calcium arsenate, 0·2 per cent. Paris green, and proprietary derris preparations, a proprietary dust containing rotenone and pyrethrum, and sprays and dusts of Gesarol [a preparation containing DDT]. Paris green formed a poor suspension. Phenothiazine and preparations of aluminium arsenate were unsatisfactory. Investigation of a French claim that the leaves of certain varieties of *Petunia* are toxic to the larvae [*cf.* **22** 665, etc.] showed that when potato and *Petunia* are both available, only the former is attacked.

WIESMANN (R.). **Untersuchungen über das Anködern der Kirschfliege *Rhagoletis cerasi* L.** [Investigations on Baits for the Cherry Fly *R. cerasi*, L.]—*Landw. Jb. Schweiz* **58** pt. 9 pp. 803–840, 8 figs., 13 refs. Berne, 1944. (With a Summary in French.)

A detailed account is given of field experiments carried out near Lake Zurich in 1939–42 in which various substances were tested as baits for *Rhagoletis cerasi*, L., in cherry orchards. Glass jars containing the bait liquids were suspended from the trees while the flies were present, and the numbers caught by each were recorded at frequent intervals. The five baits tested in 1939 comprised 0·5 per cent. ammonium fluoride with 10 per cent. sugar [*cf.* *R.A.E.*, A **26** 526], 2 per cent. ammonium stearate, 6 per cent. ammonia [*cf.* **26** 697] and water in which bran had been steeped or boiled ; 80 jars were distributed among nine trees at the rate of 6–12 per tree, and only one bait was used on a given tree. The baits were renewed after about three weeks. Between 2nd June and 17th July, 99 flies, 60 of which were females, were caught in the 21 glasses containing ammonium stearate, and none in the others or on bands of paper coated with an adhesive mixed with ammonium-stearate powder. The flies were taken only on calm, sunny days. Examination of the ovaries of 59 of the females showed that only one had oviposited.

In 1940, 41 jars containing 2 per cent. ammonium stearate, the only bait tested, were suspended in four trees, and 748 flies, 270 of which were females, were taken between 6th June and 3rd July. More were taken in the higher branches of the trees than in those lower down, and more on the east, west

and south sides of the trees than the north side. Few were taken in wet weather. Examination of the females showed that 88 per cent. had not oviposited. The distribution of infested fruits on a tree was similar to that of the fly captures, and the percentages infested at harvest, which ranged from 4 to 30 on individual trees, varied with the numbers of flies caught when the size of the crop was taken into consideration.

In view of the promising results obtained with protein baits against *Anastrepha striata*, Schin., in Mexico [**28** 468], the baits tested in 1941 included pure albumin derivatives in water and also certain albuminoids (casein, gelatine and white of egg) decomposed with sodium-hydroxide solution. The standard for comparison was 2 per cent. ammonium stearate, which caught an average of 8·8 flies per jar. Few or no flies were trapped with the albumin derivatives, none with furfurol or hippuric acid and few with betaine chloride or 2 per cent. ammonium oleate, but the casein, gelatine and white of egg with sodium hydroxide caught 20, 23·3 and 34·7 flies per jar, respectively. Males and females were attracted in almost equal numbers. In 1942, large-scale tests were carried out in which 2 per cent. ammonium stearate was compared with numerous other compounds. The results are given in tables and showed that it proved far superior to ammonia, other ammonium salts, amines, amino acids, stearic-acid derivatives, and urea, uric acid and their derivatives, to casein derivatives, white of egg and blood albumin decomposed in an alkaline medium, and to putrefying substances, though in a subsidiary test it was less than half as effective as certain baits obtained by decomposing casein with trypsin or sulphuric acid and exposing the products in an alkaline medium. In no case, however, was infestation reduced by the use of the baits.

It is concluded from all these results, and from laboratory tests in which adults of *R. cerasi* were offered 58 different odorous substances and were regularly attracted only to ammonia, that the fly reacts to the slow continuous emanation of ammonia vapour. Although, in view of their limited range, ammonia baits afford no direct control, they may be of use for determining the flight period and timing sprays. Ammonium stearate would be attractive enough for this purpose. It is not specific to *R. cerasi* ; both it and the other baits attracted many other insects, lists of which are given.

Wiesmann (R.). **Untersuchungen über neue Köderflüssigkeiten zur Kontrolle des Traubenwicklerfluges.** [Investigations on new Bait Fluids for studying the Flight of the Vine-moth.]—*Landw. Jb. Schweiz* **58** pt. 9 pp. 841–864. 5 figs., 33 refs. Berne, 1944. (With a Summary in French.)

Clysiana (*Clysia*) *ambiguella*, Hb., is an important pest of grape vines in German Switzerland, and the investigations described were carried out near Zürich in 1940–41 in an attempt to find substances that would increase the attractiveness to the moths of the standard bait of cider with 1 per cent. sugar and 4 per. cent. vinegar. The 147 tested included various hormones, odorous substances, derivatives of albumin and constituents of wine ; they were used alone in aqueous solution or added to the standard bait and were exposed in glass jars suspended in four vineyards. The results are given in tables and showed that the standard bait was more attractive than any of the test substances used alone and that its attractiveness was not increased by the addition of any of the latter. The catches accurately reflected the changes in population of the moth, but no attractant was specific for either sex. Of 496 nearly full-fed larvae collected in one locality in June 1940, 286 pupated and gave rise to adults, while 67 were parasitised by *Omorgus difformis*, Gmel., which emerged from the pupae and 143 by *Agrypon flaveolatum*, Grav., which emerged from the larvae in their cocoons.

Some of the baits tested proved attractive to other insects. Thus, geranyl formate and eugenol, in water or cider, both attracted numerous adults of

Anomala (*Phyllopertha*) *horticola*, L., although the nearest apple trees were about 500 yards distant. Some adults of *Agriotes lineatus*, L., and *Anthophila* (*Simaethis*) *pariana*, Cl., were attracted by phenylacetaldehyde in water, and a few of *Hyponomeuta padellus malinellus*, Zell., by a mixture of cider and castoreum or cider and asparagine.

Faes (H.). **Station fédérale d'essais viticoles et arboricoles à Lausanne et Domaine de Pully. Rapports annuels 1943 et 1944.**—*Landw. Jb. Schweiz* **59** pt. 8 pp. 671–707. Berne, 1945.

This report contains notes on pests and diseases of grape vines and fruit trees and their control in French Switzerland and the canton of Ticino in 1943–44. Experiments in both years against the vine moths [*Clysiana ambiguella*, Hb., and *Polychrosis botrana*, Schiff.] showed that sprays of Nirosan and Gesarol [preparations in which tetranitrocarbazole and DDT, respectively, are the active agents] were far more effective against the first-generation larvae than lead arsenate, and that the addition of a wetting agent to Gesarol rendered it as effective as Nirosan, particularly against the second generation. Almost equally good results against this generation were obtained with a spray of nicotine with a wetting agent. Dusts of Nirosan and Gesarol were only slightly less effective than sprays; these products, in either form, should be applied before the larvae hatch, and have no injurious effects on fermentation or the quality of the wine. Measures recommended for the control of *Otiorrhynchus anthracinus*, Scop. (*helveticus*, Boh.), which damages the buds of vines in the Canton of Valais, include timely and liberal applications of Gesarol spray, repeated if necessary at intervals of 4–5 days.

Weather conditions in both years favoured the development of the second generation of the codling moth [*Cydia pomonella*, L.] in Valais and near Lake Geneva, and the routine arsenical treatments were ineffective. Gesarol was also not very effective against it, although promising results were obtained with a Gesarol emulsion on apricot, which it attacks in the absence of apple. Walnut is also heavily infested. Gesarol sprays gave efficient control of *Anthonomus pomorum*, L., on apple, and *A. piri*, Koll., on pear [*cf. R.A.E.*, A **35** 69–70], and abundant petal-fall applications of Gesarol with a wetting agent gave good control of *Hoplocampa* on plum.

At Pully, P. Aubert reports that fruit trees were severely infested in 1943 by a number of pests including *C. pomonella*, the red spider [*Paratetranychus pilosus*, C. & F.] and *Lyonetia clerkella*, L. The apple spray-programme included sprays of lead arsenate (1 per cent.) with lime-sulphur and a wetting agent applied on 5th May (petal fall), 21st May and 19th June, and, on late varieties, an additional application of this spray on 14th July and one of Gesarol and a wetting agent on 12th August. Few of the fruits from the sprayed trees and over 60 per cent. of those from unsprayed ones were infested by *C. pomonella*, and the lime-sulphur greatly reduced the increase of *Paratetranychus*. The same treatments were applied to pears with similar results, except that lead arsenate was applied to the early varieties only on 19th June and to the late ones only on 19th June and 14th July, and the early pears were found to be fairly heavily infested by young second-generation larvae of *Cydia* when they were picked. In 1944 a prolonged drought favoured the multiplication of numerous pests. *C. pomonella* and *P. pilosus* were very injurious on apple trees that received three applications of the spray of lead arsenate and lime-sulphur, on 15th May (petal fall), 12th June and 6th July, and on pears that received some of these applications, and it became increasingly evident that hot seasons necessitate treatment in August with nicotine or oil sprays against the second-generation eggs of the moth. Despite the use of Gesarol sprays on 9th May (petal fall), 24th May and 8th June, all but very late varieties of plum were infested by *Hoplocampa*.

A survey in numerous mountain districts in 1943 showed that much of the blossom of apple trees and *Sorbus aucuparia* had been destroyed by a frost in early May, and the few apple fruits were heavily infested by *Argyresthia conjugella*, Zell., which usually oviposits on *S. aucuparia* [*cf.* **26** 299].

The campaign against *Leptinotarsa* (*Doryphora*) *decemlineata*, Say, on potato was continued, and quarantine measures were taken to prevent the introduction of *Quadraspidiotus* (*Aspidiotus*) *perniciosus*, Comst., on fruit or nursery stock from France and Italy [*cf.* **33** 124–5].

MARTIN (Henri). **Contribution à l'étude des silphes de la betterave en Suisse.**—*Landw. Jb. Schweiz* **59** pt. 9 pp. 757–819. 19 figs., 32 refs. Berne, 1945. (With a Summary in German.)

The greater part of this paper on pests of beet in Switzerland comprises a detailed account of observations, carried out in 1942–44, on the Silphids, *Silpha* (*Blitophaga*) *opaca*, L., and *S.* (*B.*) *undata*, Müll., which have similar life-histories [*cf. R.A.E.*, A **31** 437]. *S. opaca* is found principally in light soils in low-lying districts in the cantons of Berne, Fribourg and Zürich, whereas *S. undata* occurs in various types of soil and at altitudes of up to about 6,000 ft. in numerous localities, particularly the Rhône plain and the district of Neuhausen (Canton Schaffhausen). The synonymy of the two species is reviewed, and all stages are described, together with the digestive and reproductive systems of the adults. Laboratory and field studies showed that both species develop from egg to adult in about six weeks and have only one generation a year. Adults of *S. opaca* left their winter quarters in the soil at the time of germination of the beet, usually about mid-April, and those of *S. undata* a few days earlier. Pairing and oviposition continued throughout April and May, each female laying about 100 eggs in the soil. The first larvae appeared 8–10 days after the oviposition or 10–15 days after the beet had germinated, and fed on the edges of the leaves or on the leaf-stalk, and occasionally on the base of the seedlings. Full-fed third-instar larvae rested for 2–8 days and pupated just below the surface of the soil. Adults emerged 10–15 days later and fed on the parenchyma and occasionally on the leaf-stalks until they entered hibernation in July or August. In the laboratory, the egg, larval and pupal stages of *S. undata* averaged 10, 25 and 8 days, respectively, at 18°C. [64·4°F.] and those of *S. opaca* 4–11·5, 10·6–34·9 and 4·7–15·9 days, respectively, at constant temperatures of 29·3–14·3°C. [84·74–57·74°F.]. The optimum, maximum and minimum temperatures for the development of *S. opaca* were about 20–25, 33 and 10°C. [68–77, 91·4 and 50°F.], respectively, but oviposition did not occur at temperatures lower than 15°C. [59°F.]. Both larvae and adults avoided strong sunlight and low relative humidity. In addition to beet, *S. opaca* fed in the field on spinach and *S. undata* on wheat and barley. Cultural control measures recommended comprise thick sowing and forcing rapid growth of the plants, which become resistant to attack when they reach the four-leaf stage, but heavy infestations require chemical control measures.

In laboratory experiments, against the larvae and adults, chiefly of *S. undata*, dusts and sprays of DDT as Gesarol were compared with a commercial derris dust, dusts and sprays of lead arsenate, and bran baits sweetened with sugar and poisoned with sodium fluosilicate or calcium arsenate. All gave complete mortality of the larvae in some tests, but the DDT sprays and dusts were the only treatments that gave complete mortality of adults. Moreover, females poisoned by DDT ceased to oviposit much sooner than did those poisoned by lead arsenate. In field tests in which the treatments were applied in May, a DDT spray was more effective than 1·5 per cent. lead arsenate against *S. opaca* in 1942, prevented any further damage in heavily infested plots in 1943, and killed all the larvae and adults of *S. undata* in a field of heavily infested sugar-beet in five days in 1944.

The second part of the paper consists of notes on other insects observed on beet. They include *Aphis fabae*, Scop., and *Cassida nebulosa*, L., which are sometimes injurious, and *C. nobilis*, L., the Halticids, *Chaetocnema concinna*, Marsh., *Phyllotreta undulata*, Kutsch., and *Psylliodes affinis*, Payk., the Anthomyiid, *Pegomyia hyoscyami*, Panz., and Collembola of the genera *Smynthurus* and *Aphorura*, all of which appear to be of no importance as pests in Switzerland. The two species of *Cassida* have only one generation a year; the adults hibernate in the soil, under vegetable refuse, emerge and pair in late April or early May and oviposit in May and June. Eggs of *C. nebulosa* were laid in clusters of 5–15 on leaves of *Chenopodium album*, but not on beet, while those of *C. nobilis* were laid singly on beet leaves. The larvae hatched after about a week, fed for about three weeks and pupated on the food-plant. The adults emerged about ten days later and fed until late August, when they entered hibernation. Larvae and adults of *C. nebulosa* sometimes migrate to beet in large numbers in July and August and damage it severely. The control measures recommended include clean cultivation and the application of sprays of DDT or lead arsenate, preferably the former if the beet leaves are required for fodder.

SCHNEIDER (F.). **Schaden und Bekämpfung des Rebenfallkäfers.** [Damage by *Adoxus obscurus*, L. and its Control.]—*Schweiz. Z. Obst- u. Weinb.* **54** no. 23 pp. 411–414, 2 figs. Wädenswil, 1945.

In July 1945, severe damage to grape vines by *Adoxus obscurus*, L., was reported from several localities in north-eastern Switzerland. On emerging from the soil in spring or summer the adults of this Eumolpid, which are briefly described, feed voraciously on the vines, making slits in the leaves and grooves on the shoots and young grapes. The grooves on the berries become discoloured and many of the berries eventually burst. The eggs are laid on the leaves and old bark, and the larvae enter the soil and feed on the roots. The sporadic occurrence of the beetle may be due to the control measures practised against other insects and also to local climatic conditions, aspect and soil; the unusually light and deep soil that characterised one of the infested vineyards appeared to be particularly favourable to larval development, but *Epilobium*, which is often cited as a food-plant [*cf. R.A.E.*, A **16** 410], did not occur in the locality.

Since synthetic insecticides are replacing arsenicals in the control of vine pests, a laboratory experiment was carried out to determine the susceptibility of *A. obscurus* to Gesarol [a preparation containing DDT] and Pirox [another compound of unstated composition]. Grapes and vine-leaves sprayed on all sides with Gesarol, dusted on one side only with Gesarol or the other compound, or left untreated as controls, were kept in dishes at a relative humidity of about 85 per cent. and a temperature of 21–22°C. [69·8–71·6°F.] with 12 beetles in each dish. The Gesarol dust gave complete mortality in 48 hours and the spray in six days; the other dust did not kill all the beetles, and only one died in six days in the control dish.

SCHNEIDER (F.). **Eine Ursache der raschen Blattlausvermehrung an Bohnen.** [One Cause of the rapid Multiplication of Aphids on Beans.]—*Forsch Ergebn. Gartenb.* 1944 pt. 5 repr. [4] pp., 4 figs. 1944.

Observations in Switzerland have indicated that larvae of *Syrphus ribesii*, L., and other Syrphids fail to control *Aphis* (*Doralis*) *fabae*, Scop., on beans (*Phaseolus vulgaris*) because they usually become impaled, soon after they hatch, by the small hooked hairs on the under surface of the leaves and on the stem and die of starvation. The Aphids themselves are hindered to some

extent, and many alates are unable to free themselves from the leaves [*cf. R.A.E.*, A **27** 142]. The presence of these hairs is probably responsible for the rare occurrence of Coccinellids on beans, and is the cause of the high mortality, often amounting to about 80 per cent., of Cecidomyiid larvae predacious on the spider mite [*Tetranychus telarius*, L.].

KNECHTEL (W. K.) & MANOLACHE (C.). **Neue Blattläuse für Rumänien. (Siebenter Beitrag.)** [New Aphids for Rumania. (Seventh Contribution.)] —*Bull. Sect. sci. Acad. roum.* **26** no. 10 pp. 690–702, 5 figs., many refs. Bucarest [1944].

Aphis (*Rhopalosiphum*) *maidis*, Fitch, which transmits the virus of sugar-cane mosaic [*Marmor sacchari* of Holmes], has been collected at several places in eastern Rumania since 1933, on sorghums, which are extensively grown for fodder, and on maize, barley and wheat. It was commonest on sorghum, though it is not as yet numerous on any plant, and symptoms of virus disease were observed on infested sorghum and maize. The Aphids were most abundant on the inner side of the leaf sheaths and on their upper parts, on the inner side of the bracts of the panicle and on the panicle itself; the stem was seldom attacked. Heavy infestations caused necrosis of the affected parts, and subsequent sterility of the panicle. Observations in 1937–43 showed that some control was afforded in September by *Coccinella septempunctata*, L., *Adalia bipunctata*, L., and predacious Syrphid larvae.

The apterous and alate viviparae of *A. maidis* are described, and its synonymy, world distribution and economic importance are discussed from the literature. References to other Aphids on sorghum and maize in Rumania are included.

ALFARO (A.). **La progresión del escarabajo de la patata durante los años 1943 y 1944.** [The Spread of the Potato Beetle during the years 1943 and 1944.] —*Bol. Pat. veg. Ent. agríc.* **13** (1944) pp. 1–14, 4 figs. Madrid, 1945.

Owing to the mild winter of 1942–43 and the hot dry spring and summer of 1943, the potato beetle [*Leptinotarsa decemlineata*, Say] continued to spread in Spain [*cf. R.A.E.*, A **34** 263], and by the end of the year it had been reported from 34 of the 47 provinces. In 1944, development of the first generation was checked to a great extent by cold and wet weather, but the second generation reached unexpectedly high numbers in the late summer, and infestations were observed in all provinces except three in the extreme south-west and one in the extreme north-west [*cf.* **34** 100]. The distribution of the beetle and the new foci of infestation for both years are shown on maps.

DEL CAÑIZO (J.). **Notas sobre la mosca del garbanzo.** [Notes on the Chick-pea Fly.]—*Bol. Pat. veg. Ent. agríc.* **13** (1944) pp. 15–26, 5 figs., 8 refs. Madrid, 1945.

The author reviews the work of Shevchenko [*R.A.E.*, A **25** 662] on the bionomics of *Agromyza* (*Liriomyza*) *cicerina*, Rond., on chick-pea (*Cicer arietinum*) in the Ukraine, and compares it with his own earlier observations in Spain [**22** 608].

BENLLOCH (M.). **Un Miriápodo perjudicial en huertas y jardines** (*Scutigerella immaculata* **Newp.**). [A Myriapod injurious in Gardens (*S. immaculata*).] —*Bol. Pat. veg. Ent. agríc.* **13** (1944) pp. 39–46, 5 figs., 9 refs. Madrid, 1945.

In view of considerable damage by *Scutigerella immaculata*, Newp., in a garden in Madrid, the author gives an account based on the literature of its bionomics and control [*cf. R.A.E.*, A **20** 356; **23** 562; **30** 110, etc.].

Planes (S.). **La "roña" de los frutos cítricos.** [Scabbiness of Fruits of *Citrus*.]—*Bol. Pat. veg. Ent. agríc.* **13** (1944) pp. 47–54, 5 figs. Madrid, 1945.

A mite of the genus *Tenuipalpus*, thought to represent a new species, was found attacking oranges in a coastal district of Valencia in 1939 and subsequently in other localities in that province and in Castellon. It has not so far been observed inland. The adult and egg are briefly described, and characters are given distinguishing it from related species that infest *Citrus* elsewhere. It occurs on all varieties of orange and mandarin orange. The chief damage is to the fruits, which lose all commercial value owing to pitting and splitting of the skin, but the petioles are also attacked if the mites are numerous and partial defoliation results. The eggs are laid in small groups, usually on the fruits, favoured sites being lesions caused by thrips, by the mites themselves or by insecticides, and round the scales of *Lepidosaphes beckii*, Newm. The egg stage lasted about 20 days at 15–20°C. [59–68°F.] The first moult takes place two weeks after hatching and the second five days later, and oviposition begins after a further five days. The infestation develops slowly; from February, after the harvest, until May, eggs and adults were found on second-crop oranges and on fruits of lemon trees growing among orange trees, and oviposition on the green fruit of the main crop was first observed at the beginning of July. Infestation was considerable in August, reached its peak in September–October and decreased with the onset of cold weather, when the mites shelter on the peduncles.

Satisfactory control was given by spraying with 2 per cent. lime-sulphur (28–30°Bé.) when the mites first appeared on the green fruit. During the early spring, second-crop oranges should be picked and submerged in 2 per cent. lime-sulphur, and this spray should also be applied to any lemon trees growing in the orchard.

Ruiz Castro (A.). **Un cóccido ampelófago, nuevo en España** (*Diaspidiotus uvae* (**Comstock**)). [*D. uvae*, a Coccid Pest of Vines, new to Spain.]—*Bol. Pat. veg. Ent. agríc.* **13** (1944) pp. 55–74, 8 figs., 12 refs. Madrid, 1945.

In 1933, a Diaspine Coccid, identified as *Diaspidiotus uvae*, Comst., which had not previously been reported from Spain, was found infesting the trunks and branches of grape-vines in Almeria, causing considerable injury. The distribution and systematic position of *D. uvae* are reviewed from the literature, the adults of both sexes are described, and a key to the genera of Diaspine Coccids found in Spain is reproduced.

D. uvae has only one generation a year; the winged males appear and the females produce their young in May and June, and the crawlers wander for about two days before becoming fixed. The scales were generally found under the bark of the trunk and limbs of young vines, and hindered normal growth when they were abundant. Lists are given of the food-plants and natural enemies of *A. uvae* in the United States. In Spain it was also found on myrtle (*Myrtus communis*) and some evidence of parasitism was observed. The author considers that effective control would be obtained by spraying with a petroleum-oil emulsion at dormant strength. It should be applied after pruning and before the vines start to bud, and the old bark should be stripped from the branches. Lime-sulphur sprays, the preparation of which is described, and tar-distillate emulsions did not give a satisfactory mortality.

Bellod (M.). **Tratamiento de invierno contra la oruga verde del almendro** (*Episema* ó *Diloba caeruleocephala* **L.**). [Winter Treatment against the Green Almond Worm, *D. coeruleocephala*.]—*Bol. Pat. veg. Ent. agríc.* **13** (1944) pp. 75–82, 6 figs., 2 refs. Madrid, 1945.

Experiments were carried out in the Province of Valencia in the early spring of 1944 on the control of *Diloba coeruleocephala*, L., on almond by spraying

against the overwintering eggs [*cf. R.A.E.*, A **34** 266]. The experimental trees had been heavily attacked in 1943, but the egg population at the time of the treatments was so light that no conclusive results could be obtained in the field. However, four branches bearing eggs of *D. coeruleocephala* were attached to four trees, sprayed with them and then brought into the laboratory, and observation of these showed that a spray of lime-sulphur with a wetting agent was ineffective, as was also one of 4 per cent. crude tar oil emulsified with quicklime, which formed a coarse emulsion, but complete mortality was given by a spray containing only half as much tar oil with an equal amount of petrol emulsified with ammonium caseinate and also by 2 per cent. of a proprietary mineral-oil emulsion. None of the sprays scorched the trees, although the flower buds were already swelling at the time of treatment. The sprays should be applied as early as possible, but not before the beginning of December, since oviposition may not be completed before then.

ALFARO (A.). **Nueva plaga en los cerezos zaragozanos** *Monima stabilis* **View.** [*Orthosia stabilis*, a new Pest of Cherry in Saragossa.]—*Bol. Pat. veg. Ent. agríc.* **13** (1944) pp. 149–160, 11 figs., 7 refs. Madrid, 1945.

Larvae of *Orthosia* (*Monima*) *stabilis*, Vieweg, caused serious damage to cherry trees near Saragossa in 1942, and were present though less numerous in the two following years. All stages of this Noctuid are described and its geographical distribution is reviewed. It has been recorded from several parts of Spain and is polyphagous, but economic damage has been reported only on cherry. The newly-hatched larvae feed on the young shoots, to which they attach themselves with silk threads, while the older larvae attack the larger leaves and also the fruit.

In the laboratory, adults emerged from overwintered pupae between mid-February and mid-March and began to oviposit after 7–14 days. The eggs were laid in groups of 16–146 in layers near the buds ; the largest number laid by one female was about 500 deposited in the course of seven days. The egg stage lasted 14–17 days, and the larvae, which were fed on leaves of plum, completed their development in 30–39 days. The larvae usually enter the soil in the first half of May in Spain and pupate after a prepupal stage thought to last not more than 5–7 days ; there is only one generation a year.

In orchards in which cultivation involves ridging the soil, the pupae occur mostly in the upper part of the ridges, and they were effectively controlled by digging the crests down into the irrigation channels and flooding them. Turning over the top layer of the soil and destroying the pupae exposed is also suggested. Spraying the trees with suspensions of 0·5–0·75 per cent. lead arsenate against the larvae is recommended, provided that the treatment is applied before the fruits ripen, to avoid the danger of toxic residues. A DDT spray was also very effective against the larvae, causing them to cease feeding in 24–48 hours.

GOMEZ-CLEMENTE (F.) & BELLOD (M.). **Duración del poder atrayente que sobre el** *Dacus oleae* **(Rossi) ejercen las soluciones de fosfato amónico.** [The Duration of the Attraction for *D. oleae* of Solutions of Ammonium Phosphate.]—*Bol. Pat. veg. Ent. agríc.* **13** (1944) pp. 199–208, 4 figs. Madrid, 1945.

During experiments in the Province of Valencia in 1943 on the control of *Dacus oleae*, Gmel., on olive by means of glass traps baited with solutions of ammonium phosphate, it was found that the liquid had to be renewed frequently owing to loss by evaporation. This rendered the method uneconomic in

comparison with others, since water usually is scarce in olive groves. The cause of the rapid evaporation was found to be the unsuitable shape of the traps used, and when in 1944 flasks with a capacity of 325 cc. narrowing to a cylindrical neck that could be tightly sealed, and with an orifice in the bottom 15 mm. in diameter, were used, the liquid required 45–50 days to evaporate completely.

Experiments were carried out with traps of this type in the late summer and autumn of 1944 to ascertain how frequently a bait of 4 per cent. ammonium phosphate needs to be renewed to maintain maximum efficiency, the results obtained with baits left unchanged for various periods being compared with those obtained in other groves with baits that were renewed every fortnight. In one series, the positions of the traps were changed when counts were made to eliminate effects due to variation in trees. The figures obtained, which are shown in tables and discussed, were not entirely consistent, since the oldest baits sometimes attracted more flies than the newest ones, but the attractiveness of the liquid in general appeared not to diminish for about 40 days, after which it fell off rapidly. In practice, therefore, renewal every 30 days would be sufficient.

Ruiz Castro (A.). **Análisis químico del fosfato amónico como producto fitoterapéutico.** [Chemical Analysis of Ammonium Phosphate as a Material for Plant Protection.]—*Bol. Pat. veg. Ent. agríc.* **13** (1944) pp. 209–228, 1 fig., 10 refs. Madrid, 1945.

The author describes further investigations on methods of analysing commercial ammonium phosphate to determine its effectiveness as an attractant for *Dacus oleae*, Gmel. [*cf. R.A.E.*, A **34** 268]. The commercial product almost always consists of a mixture, usually of the monammonium and diammonium phosphates, or sometimes of the di- and tri-ammonium salts or of monammonium phosphate and phosphoric acid. It generally also contains ammonium sulphate, ammonium chloride, and small quantities of calcium sulphate and calcium chloride and the insoluble tricalcium, iron and aluminium phosphates. The author shows that for a full analysis it is necessary to determine the quantities of phosphorus pentoxide in the soluble portion of the mixture and, if there is much insoluble matter, in the whole mixture, and the content of ammonium and sulphate radicles and of chlorine and calcium, and gives details of the methods by which the composition of the mixture can be calculated from these results.

Quintana-Marí (A.). **Contribución al estudio físico-químico del βββ-tricloro-αα bis-(p. clorofenil)-etano y su determinación analítica en los insecticidas preparados a base del mismo.** [A Contribution to the physico-chemical Study of DDT and its analytical Determination in Insecticides.]—*Bol. Pat. veg. Ent. agríc.* **13** (1944) pp. 229–270, 10 figs., 26 refs. Madrid, 1945.

Since it was not known in Spain which of the numerous compounds that correspond to the general chemical name of pentachlordiphenylethane was the active principle in Gesarol and similar insecticides, investigations on its identity and properties were begun in 1944. The material used for analysis was obtained by extraction from Gesarol. The work is described in detail and it was concluded that the active principle is βββ-trichlor-αα bis (p-chlorphenyl)-ethane [commonly known as DDT]. The author describes and discusses methods of analysing the DDT content of insecticides, the best of which is similar to one already noticed [*cf. R.A.E.*, A **35** 115].

URQUIJO [LANDALUZE] (P.). **Ensayo del parásito útil *Trichogramma minutum* en la lucha contra la polilla de la patata.** [An Experiment with the useful Parasite *T. minutum* in the Campaign against the Potato Moth.]—*Bol. Pat. veg. Ent. agríc.* **13** (1944) pp. 281–300, 8 figs. Madrid, 1945.

The breeding of *Trichogramma minutum*, Ril., and *T. pretiosum*, Ril., in eggs of *Sitotroga cerealella*, Ol., in north-western Spain [*cf. R.A.E.*, A **33** 125], was continued on an even wider scale during 1944. The growth of various laboratory colonies of *T. minutum* and *T. pretiosum* is shown in tables. In the course of their development, it was observed that the strains used did not appear to be pure, owing either to impurity in the original stock received from the United States, or to later intermingling. The presence of these variations suggested the possibility of separating strains with improved reproductive powers. Counts were accordingly made of the males and females in several generations of one colony of *T. minutum* and four colonies of *T. pretiosum* and in one of *T. minutum*. Females were found to average 40, 61, 67, 65 and 63 per cent. of the total in these five colonies, respectively, and the average percentages of viable parasites produced in eggs of *Sitotroga* were found to be 85, 11, 48, 54 and 47. The author states that several strains separated by him showed increased viability.

The value of *Trichogramma minutum* for the control of *Gnorimoschema* (*Phthorimaea*) *operculella*, Zell., in stored potatoes in the coastal districts of Corunna and Pontevedra, was tested in 1944. Consignments containing an average of 18,000 parasitised eggs of *S. cerealella* and 5,000 unparasitised eggs to provide hosts in case the parasites emerged early or could find none in the store, were despatched to growers as soon as their potatoes were lifted, and more than half of them reported satisfactory results. In some cases, the parasites were unable to establish themselves, since host eggs were not available. At 20°C. [68°F.], the life-cycle of *G. operculella* lasts 40–45 days, with an egg stage of 7 days, and that of *Trichogramma* 14 days, with an oviposition period of about 48 hours, and the population changes that will take place when the parasites are released at various stages in the life-cycle of the host are discussed. To avoid the extinction of colonies owing to the temporary absence of host eggs, the colonies sent out later consisted of parasites due to emerge on different dates, and it was proposed to distribute sets of three colonies, timed to emerge at intervals of a week, in order to provide a better chance of establishment.

DEL CAÑIZO (J.). **Las agallas foliares de los *Ficus* ornamentales.** [Leaf-galls of ornamental Fig Trees.]—*Bol. Pat. veg. Ent. agríc.* **13** (1944) pp. 323–334, 14 figs., 8 refs. Madrid, 1945.

The leaves of *Ficus nitida*, which is used as an ornamental tree in parks and avenues of Almeria and Murcia, are deformed by *Gynaikothrips ficorum*, Marchal. The geographical distribution and food-plants of this thrips are reviewed, and all stages are briefly described. The adults attack the upper surface of the young leaves and cause the midrib to twist and the two sides to come together, forming galls in which large colonies of the thrips develop [*cf. R.A.E.*, A **34** 19]. Serious damage is caused in heavy infestations, as the growth of the young shoots is prevented, and development continues throughout the year. The leaf-galls often serve as a winter refuge for other insects, such as the Coccids, *Pseudococcus citri*, Risso, and *P. adonidum*, L. [**24** 218]. The eggs and probably also the larvae and nymphs of *G. ficorum* are destroyed by the Anthocorid, *Montandoniella moraguesi*, Put. Control by means of contact insecticides is difficult, since the pest is protected by the galls, but fumigation with hydrocyanic acid gas is recommended, using the same dosage as for *Liothrips* (*Phloeothrips*) *oleae*, Costa [**15** 418]. This should be applied at the coldest time of the year, when eggs are scarce, and with due precautions when the trees are close to houses.

Moreno Márquez (V.). **Zonas permanentes de langosta, en España : boceto ecológico de La Serena.** [Permanent Zones of Locusts in Spain : Ecological Sketch of La Serena.]—*Bol. Pat. veg. Ent. agríc.* **13** (1944) pp. 335–376, 21 figs., 1 fldg. map, 16 refs. Madrid, 1945.

Since outbreaks of *Dociostaurus maroccanus*, Thnb., originate in a district in the east of the Province of Badajoz, known as La Serena [*cf. R.A.E.*, A **26** 698], it is desirable to ascertain the exact areas in which transformation from the solitary to the gregarious phase occurs. The author therefore carried out a survey during the years 1941–44, and gives a detailed account of the geological formations, climatic conditions, natural water supplies, wild flora and crops of the region, with tables showing soil analyses. In addition to *D. maroccanus*, the Acridids, *Calliptamus italicus*, L., *C. ictericus*, Serv., *Chorthippus brunneus*, Thnb. (*Stauroderus bicolor*, Charp.), *Oedipoda coerulescens*, L., *O. charpentieri*, Fieb., and *Ocnerodes brunneri*, Bol., and several Tettigoniids were observed. Owing, however, to the recent outbreak of *D. maroccanus*, which had been largely controlled by natural enemies and the use of poison baits [*cf.* **29** 529], solitary locusts were not present, so that no permanent foci could be found.

Mendizábal (M.) & Morales Agacino (E.). **Algunos datos sobre una invasión ocasional de *Schistocerca gregaria* (Forsk.) en la provincia de Almería.** [Some Notes on an isolated Invasion by *Schistocerca gregaria* in the Province of Almeria.]—*Bol. Pat. veg. Ent. agríc.* **13** (1944) pp. 377–384, 1 fig., 1 fldg. graph, 4 refs. Madrid, 1945.

During May 1944, the eastern part of Andalusia was invaded by swarms of *Schistocerca gregaria*, Forsk., a very unusual occurrence, particularly in Almeria, where no such invasion had been reported since 1876. The locusts had evidently been carried over from Morocco by strong winds, for flying swarms were observed over the island of Alborán and over ships at sea. Several bands landed in an exhausted condition in the coastal regions of Malaga, Almeria and Granada, while many others were washed up by the sea. From the information available, the author gives a map showing the probable directions followed by the various swarms, which all eventually disappeared without causing serious damage.

Examples collected in Almeria were deep yellow in colour, indicating sexual maturity, and their body ratios, while approximating to those of the typical phase *gregaria*, suggested that transformation towards phase *transiens* had begun. Females predominated over males, and although oviposition was not general, some eggs were laid.

Four months after the invasion, a male locust was captured. It was thought to have developed from an egg laid by one of the invading females, since it showed no traces of long flight and was judged to be not more than three months old. From its appearance and colouring it was considered to belong to phase *transiens dissocians*, but its body ratios were more closely related to those of the typical phase *solitaria* ; no other examples were found in the neighbourhood.

The body measurements of locusts taken in Almeria, data on the movements of swarms and climatic records for the period are given in appendices.

Alfaro (A.). **La lucha química contra el escarabajo de la patata en España.** [Chemical Methods against the Potato Beetle in Spain.]—*Bol. Pat. veg. Ent. agríc.* **13** (1944) pp. 385–428, 2 figs., 16 graphs (2 fldg.), 10 refs. Madrid, 1945.

The author enumerates the insecticides in common use against *Leptinotarsa decemlineata*, Say, on potato in Spain, and describes experiments carried out to estimate their comparative efficiency. In the fields used for the tests, selected

plants, bearing known numbers of larvae and adults were caged immediately after treatment, and the average mortality calculated from daily counts of the dead insects in each cage, over a period of four days. Insects showing any sign of movement (including those almost completely paralysed by DDT) were not counted as dead.

Sprays of lead arsenate (30·46 per cent. total As_2O_5) gave complete mortality of third- and fourth-instar larvae at a concentration of 1 per cent., and 50 and 53 per cent. mortality of adults at 1·25 and 1·5 per cent., respectively; the rate of application in all cases was about 90 gals. per acre. The mortalities obtained when sprayed plants were re-infested after five and 14 days showed that the insecticide retained a high degree of toxicity, but it is pointed out that conditions in cages are not comparable to those in the open field. When a 0·5 per cent. suspension was applied to well-developed plants during a rainless period, a rate of application of 90 gals. per acre was considerably more effective than one of 45 gals. per acre and almost as effective as 135 gals. In a further experiment, complete mortality of second- and fourth-instar larvae was given in two and three days, respectively, and 50 per cent. mortality of newly-emerged adults in four days, by 0·75 per cent. lead arsenate at about 87 gals. per acre, and this combination was considered adequate for normal use.

Calcium arsenate, Paris green and Gesarol were subsequently compared with lead arsenate in parallel tests. When 1 per cent. lead arsenate and calcium arsenate (30 per cent. As_2O_5) were applied at about 81 gals. per acre to incompletely developed plants, both gave complete mortality of larvae immediately after application, but calcium arsenate lost its toxicity sooner. A dust of calcium arsenate (17 per cent. As_2O_5), at a rate of almost 47 lb. per acre, gave 100 and 60 per cent. mortality of larvae and adults, respectively, as compared with 100 and 56 per cent. for a comparable lead-arsenate spray.

The Paris green contained 53·03 per cent. As_2O_3 and was prepared as a 0·2 per cent. suspension with 0·4 per cent. quicklime to prevent scorching. At a rate of application of 81 gals. per acre, the percentage mortality of well-grown larvae was 96, as compared with 92 for 0·75 per cent. lead arsenate. Nevertheless, the danger of scorching is so great, even with the addition of quicklime, that the use of Paris green is not recommended where safer insecticides are obtainable.

A 1 per cent. suspension of Gesarol (5 per cent. DDT with an inert diluent) at the rate of 76·5 gals. per acre killed 100 per cent. of the larvae in four days and 86 per cent. on reinfestation after ten days, the corresponding percentages for the adults being 86 and 73. The percentages for 1 per cent. lead arsenate at 81 gals. per acre were 100 and 100 for the larvae and 40 and 37 for the adults. In an experiment to test the stability of a 1 per cent. suspension of Gesarol, the upper half of a suspension, siphoned off ten minutes after preparation, gave 90 and 67 per cent. mortality of larvae and adults, respectively, in four days. When the rate of sedimentation of Gesarol was compared with those of various brands of lead arsenate and calcium arsenate, those of barium fluosilicate and of Paris green alone and with various proportions of quicklime, 60 per cent. of the Gesarol remained in suspension ten minutes after preparation by which time all the other insecticides had completely settled.

Barium fluosilicate and sodium fluosilicate were used in Spain against *L. decemlineata* when arsenicals were unobtainable. In the tests, poor results were obtained with sprays, but a dust of barium fluosilicate and kaolin (1 : 4) at the rate of 90 lb. per acre, killed all the larvae and 33 per cent. of the adults in four days, while a similar dust of sodium fluosilicate and kaolin, at a slightly lower rate of application, gave 62 per cent. mortality of larvae in three days, after which heavy rain completely washed the deposit from the leaves. Sodium fluosilicate is liable to cause scorching, and both insecticides are costly in use.

Benitez Morera (A.). *Pimpla instigator* **Grav., parásito de la oruga de la col.** [*Pimpla instigator*, a Parasite of *Pieris brassicae*.]—*Bol. Pat. veg. Ent. agríc.* **13** (1944) pp. 463–466, 5 figs., 2 refs. Madrid, 1945.

The author reports the finding, for the first time in Spain, of pupae of *Pieris* (*Mancipium*) *brassicae*, L., parasitised by *Pimpla instigator*, F., near Cadiz in 1944. This Ichneumonid is a solitary parasite, so that it is probably more effective than *Pteromalus puparum*, L., and *Apanteles glomeratus*, L., which were also parasitising *Pieris brassicae* in the same field. The larvae and adults of *Pimpla instigator* are briefly described ; the latter were present in late March and early April.

Benitez Morera (A.). **Un parásito interesante de la** *Ocnogyna baetica*, **var.** *meridionalis* **Seitz.** [An interesting Parasite of *O. baetica* var. *meridionalis*.] —*Bol. Pat. veg. Ent. agríc.* **13** (1944) pp. 467–470, 2 figs., 4 refs. Madrid, 1945.

More than 50 per cent. of a considerable number of larvae of *Ocnogyna baetica* var. *meridionalis*, Seitz, that were 3–4 days old and were collected near Cadiz in December 1944, were found to be parasitised by a species of *Apanteles*. The author considers this species to be the same as the one that parasitises the Arctiid in Morocco [*cf. R.A.E.*, A **33** 170], but that the identification of the latter as *A. spurius*, Wesm., is probably erroneous. *A. spurius* is stated in the literature to be usually a gregarious parasite, whereas the species that attacks *Ocnogyna* is solitary. As the larvae of *Ocnogyna* do not migrate to crops until they are half-grown [*cf.* **17** 247] and the larvae parasitised by *Apanteles* die in the first or second instar, the parasite is of economic importance.

Mendizábal (M.). **Nota previa sobre la** *Euzophera nelliella* **Rag. (Lep. Pyralidae), nueva plaga del olivo en Andalucía oriental.** [A preliminary Note on *E. nelliella*, a new Pest of Olive in eastern Andalucia.]—*Bol. Pat. veg. Ent. agríc.* **13** (1944) pp. 471–476, 7 figs., 3 refs. Madrid, 1945.

Euzophera nelliella, Rag., which had not previously been recorded as a pest, was recently found boring beneath the bark of large branches of olive at Quesada in the Province of Jaén and at Nijar in Almeria. Branches that were completely girdled by this Pyralid died. The larvae pupated beneath the bark, and adults emerged in the laboratory in the first half of April. The only method of control suggested is to cut out the larvae with a knife.

Baptista (J. E.). **O emprêgo da argila e do enxôfre como repulsivos na luta contra o** *Dacus oleae* **Gmel.** [The Use of Clay and Sulphur as Repellents against *D. oleae*.]—*Agron. lusitana* **5** no. 1 pp. 57–66, 2 figs., 4 refs. Sacavém, 1943. (With a Summary in English.)

The value of clay and sulphur for repelling the ovipositing females of *Dacus oleae*, Gmel., from olives [*R.A.E.*, A **26** 350] was confirmed by experiments carried out at Sacavém in Portugal. The trees, about 13 ft. high, were sprayed with a mixture of 50 lb. clay, 5 lb. copper sulphate and 5 lb. lead arsenate per 100 gals. water, with a wetter, and immediately afterwards dusted with sulphur. The copper sulphate was included as a fungicide and the lead arsenate against *Prays oleellus*, F. Three treatments were given, the first on 17th July when the olives were just becoming suitable for oviposition by *D. oleae*, and the others on 18th August and 13th October. One tree was also dusted with sulphur and another given the complete treatment in November. About 5 gals. spray and 4½ lb. sulphur were used per tree at each treatment. The sulphur did not adhere well and much of it was carried away by the wind. The treated trees appeared healthy and fewer leaves dropped from them than

from control trees ; they showed a light deposit of clay, regularly distributed except on the highest branches. Since the deposit was lighter on the upper branches the olives from the top third and from the lower two-thirds of the trees were gathered separately, and examination of samples showed that the percentages attacked were 7·6 and 4·4, respectively, as compared with 47·5 and 55·4 for no treatment. The supplementary treatments in November were of little value.

ROSA DE AZEVEDO (A.). **O valor da colheita precoce da azeitona como método preventivo de combate ao *Dacus oleae* Gmel.** [The Value of early Harvesting of Olives as a Preventative against Damage by *D. oleae*.]—*Agron. lusitana* **5** no. 1 pp. 83–89, 1 graph. Sacavém, 1943. (With a Summary in English.)

Much of the damage to olives due to infestation by *Dacus oleae*, Gmel., in Portugal can be prevented by early harvesting ; though this may involve some loss of oil, the loss may be no greater than that caused by progressive infestation and the oil is of finer quality. Furthermore, many larvae are destroyed in the press if the olives are picked early, with the consequent elimination of late-formed pupae, which give rise to adults in spring. Adults that emerge before or during winter cannot oviposit until the following June or July, when olives of the fresh crop become available, and many do not survive so long. Early picking will thus afford some control of the fly in districts in which it can be practised early enough.

In preliminary experiments in 1941–42 at Sacavém, infested olives were gathered daily from 3rd October to 29th January and spread out on cotton-wool. The larvae emerged from the fruits and pupated in the cotton wool, and the pupae were placed in the ground under cages. Records of the emergence dates of the resulting adults showed that emergence from pupae formed by 21st October was completed by 11th December, while emergence from those formed between 29th October and 29th January did not occur until February, March or April. It was concluded that in this district, harvesting in mid-October would prevent the emergence of any adults after November.

BALD (J. G.). **Transmission of Potato Virus Diseases. 4. Ground Work Studies on the Growth of normal Potato Foliage.**—*J. Coun. sci. industr. Res. Aust.* **17** no. 2 pp. 94–111, 3 graphs, 8 refs. Melbourne, 1944.

BALD (J. G.), NORRIS (D. O.) & HELSON (G. A. H.). **5. Aphid Populations, Resistance and Tolerance of Potato Varieties to Leaf Roll.**—*Bull. Coun. sci. industr. Res.* no. 196, 32 pp., 2 graphs, 16 refs., multigraph. Melbourne, 1946.

In the fourth paper of this series [*cf. R.A.E.*, A **32** 300 ; **33** 33], differences in the rate of increase of the leaf area of potato plants of a number of varieties and strains commonly grown in Australia are correlated with differences in the time of inception of several developmental stages, such as axillary growth, and rate of axillary growth with the time taken to reach maturity. In the fifth, the authors describe investigations on the possible preferences of the Aphid vectors of the leaf-roll virus [*Corium solani* of Holmes] for the different varieties of potato, the extent to which the relative proportions of plants of different varieties infected in field trials depend on a different response of the plant tissues to inoculation by the insects, and how far the size and yield of infected plants are reduced.

The following is partly based on the authors' summary. Counts of Aphids and of numbers of plants becoming infected were made in field tests in which healthy potato plants of different varieties were grouped round plants of the variety Up-to-Date infected with leaf roll. *Myzus persicae*, Sulz., showed no preference between varieties or between diseased and healthy plants. The other

common vector, *Macrosiphum solanifolii*, Ashm. (*gei*, auct.), showed no preference between healthy plants of the varieties tested and young infected plants that were relatively unaffected by the disease, but avoided plants in which infection had caused serious stunting. There were indications that the stage of development of the plant influenced the preferences of both Aphids, similar populations of a given species developing on varieties that reached similar stages of development within eight days of each other. Comparison of the numbers of immature and mature Aphids on plants at the same stage of development showed no differences in population or in the fluctuation of populations for different varieties of potato. The population curves for *Myzus persicae* were typical of a relatively mature population in which there was considerable overlapping of generations and those for *Macrosiphum solanifolii* of the establishment and quick decline of a population of Aphids.

Significant differences in susceptibility of potato varieties to infection with leaf roll, which could be attributed only to reactions of the plant tissues, were observed. A method is shown of calculating the probability of a healthy plant becoming infected from the percentage of plants of that variety that have been infected. The use of the ratio of this value for a standard susceptible variety to the value for the variety under test as an index of resistance gave comparable results in tests made in the field and in the greenhouse for several varieties. According to this index, the variety Bismark is seven or eight times as resistant as the susceptible variety Up-to-Date, and other commonly grown Australian varieties are intermediate in susceptibility.

The varieties tested differed widely in tolerance to infection, as manifested by the relative sizes of diseased and healthy plants, the severity of symptoms and the yield. Although the yield does not always give a consistent measure of tolerance, the extremes of tolerance and intolerance may be clearly differentiated by this criterion. The most intolerant as well as the most resistant of commonly grown Australian varieties of potato is Bismark, and it is shown how the combination of these two factors may tend to eliminate leaf roll from Bismark crops under conditions that favour a rapid increase of infection in crops of the susceptible and tolerant variety, Up-to-Date. It is suggested that the efficiency of *M. solanifolii* as a vector of leaf roll in crops of intolerant varieties is low because of its avoidance of potato plants stunted by infection.

BIRCH (L. C.). **Diapause in** *Scelio chortoicetes* **Frogg. (Scelionidae), a Parasite of the Eggs of** *Austroicetes cruciata* **Sauss.**—*J. Aust. Inst. agric. Sci.* **11** no. 4 pp. 189–190, 6 refs. Sydney, 1945.

Examination of several thousand eggs of *Austroicetes cruciata*, Sauss., collected in 1940 at Wilmington and Orroroo, South Australia, showed that a small proportion were parasitised by *Scelio chortoicetes*, Frogg. At Wilmington at the end of April, nearly all the parasites were first-instar larvae, and a few were pupae. A few adults emerged during May–July from host eggs in the field, but most of the parasites remained as first-instar larvae until September ; these had pupated by the middle of that month, when the majority of the grasshoppers had hatched. The date of emergence of these parasites is not known, but the females are abundant in November round ovipositing females of *A. cruciata*. No adult parasites emerged from a batch of 40 host eggs containing first-instar larvae collected in March and kept at 30°C. [86°F.] for four months, but adults emerged in 42 days from all eggs of a similar batch collected in mid-June and kept at the same temperatures. Another batch of 40 eggs collected in mid-June was exposed to temperatures of 8 and 13·5°C. [46·4 and 56·3°F.] on alternate days for 18 days, and the parasites emerged after a further 18½ days at 30°C. It is concluded that the first-instar larvae pass through a diapause that is not completely eliminated by mid-June, when unparasitised eggs of the grasshopper resume development [*cf. R.A.E.*, A **30** 511] ; the

later resumption of activity enables the life-history of the parasite to synchronise with that of the host.

Parasitised eggs collected in March and kept for six weeks over concentrated sulphuric acid at 13·5°C. remained turgid and retained 66 per cent. water, which is about the normal quantity in unparasitised eggs at this season, and the parasite larvae were still alive. This resistance of the eggs to desiccation is probably associated with the absence of a developing embryo [**30** 510–511]. The presence of mouth-parts in the first-instar larva of *S. chortoicetes* suggests that it feeds on the host embryo, and its diapause suggests that the remaining material in the egg, which is mostly yolk, does not provide suitable nutrition until it has undergone some change dependent on low temperatures [*cf.* **31** 350].

Jenkins (C. F. H.). **D.D.T. as an agricultural Insecticide.**—*J. Dep. Agric. W. Aust.* (2) **22** no. 3 pp. 229–232. Perth, 1945.

Kemp (H. K.). **DDT—its Use and Value as a horticultural Insecticide.**—*J. Dep. Agric. S. Aust.* **49** no. 6 pp. 239–244. Adelaide, 1946.

In the first paper, a table is given showing the results of experiments in Western Australia in 1944–45 in which sprays and dusts containing DDT were applied against insects and mites of importance on fruit and agricultural crops. The second contains a table summarising the results of similar experiments throughout Australia in the same period [some of which are noticed in the next abstract], an account of those carried out in South Australia, and general information on the insecticidal properties of DDT and the forms in which it is available, and a discussion of its toxicity to plants, mammals, and beneficial insects.

DDT was used in dusts at concentrations of 0·25–10 per cent. and in sprays (suspensions or emulsified solutions) at concentrations of 0·05–0·5 per cent. A dust containing 1 per cent. DDT and sprays containing 0·1 per cent. DDT as a suspension or in solvent naphtha emulsified with Wetsit were the only materials used in Western Australia. A comparison of the two tables indicates that DDT was effective against Jassids, Lepidopterous larvae, weevils, and *Caliroa limacina*, Retz., but not against Coccids and mites, or, in general, Aphids; the results with other insects were variable.

The experiments in South Australia, included two orchard tests of sprays against the codling moth [*Cydia pomonella*, L.], in which the percentages of infested and (in brackets) marked apples were 18·4 (34·1) and 13·1 (25) for 0·1 per cent DDT, 58·6 (73·5) and 38·6 (66·3) for 0·4 per cent. lead arsenate with white oil (1 : 80) and, in the first test, 25·8 (42·8) for 0·05 per cent. DDT with white oil (1 : 80). The DDT sprays were suspensions of 10 per cent. DDT on pyrophyllite. In another test, top-dressings of superphosphate, alone or containing 2 per cent. DDT or 2 per cent. gammexane (the γ isomer of benzene hexachloride) were broadcast at the rate of 2 cwt. per acre on pasture infested by the red-legged earth mite [*Halotydeus destructor*, Tucker]. The average number of mites in circles 3 inches in diameter on 20th October, before treatment, and two, nine and 16 days later were 66·8, 43·0, 32·3 and 43·5 for superphosphate alone, 70·2, 0·2, 3·9 and 3·1 for DDT, and 95·6, 0·0, 0·2 and 0·5 for gammexane, despite a rainfall of 1·91 ins. between 22nd and 29th October.

Helson (G. A. H.) & Greaves (T.). **The Use of DDT as an agricultural Insecticide. Results of Trials, 1944–45.**—*J. Coun. sci. industr. Res. Aust.* **18** no. 4 pp. 301–309, 3 refs. Melbourne, 1945.

The results are given of experiments carried out in Australia between July 1944 and July 1945 by the Council for Scientific and Industrial Research on the use of DDT against agricultural pests. The tests were made with DDT

dusts and with sprays prepared from a concentrate consisting of 1 lb. DDT in 5 pints solvent naphtha, with the addition of 0·5 pint emulsifier. This formed a very stable emulsion when added to water. White-oil emulsions containing DDT proved unsatisfactory, since petroleum oils seldom dissolve more than 5 per cent. DDT, and the DDT was sometimes thrown out of solution on dilution to the final spray strength. Eucalyptus oil, which dissolves 25 per cent. DDT at room temperatures, formed very stable emulsions with many emulsifying agents and appeared to make satisfactory sprays. DDT dusts were harmless to crops, and solvent-naphtha emulsion containing 0·1 per cent. DDT did not injure potato plants ; the same emulsion containing 0·2 per cent. DDT caused no damage to many plants in Northern Queensland, but affected cucumber seedlings seriously and lucerne and papaya seedlings slightly. White-oil emulsions containing 0·1 per cent. DDT reduced the growth of bean seedlings to a varying degree, and eucalyptus-oil emulsion containing DDT caused some reduction ; the solvent-naphtha emulsion caused only slight stunting.

In preliminary laboratory experiments, 1 per cent. DDT dust gave complete mortality of adults of *Nysius vinitor*, Bergr., in 17 hours. Adults of *Nezara viridula*, L., that were fastened to slides with paraffin wax died when technical grade DDT crystals were applied to various parts of their bodies ; those dusted on the antennae succumbed first, followed by those dusted on the tarsi, and the last to die were those dusted on the thorax or abdomen. The bugs also died when their antennae were treated with a small amount of a supernatant mixture of DDT and distilled water. Dusts of 0·1, 0·25, 0·5, 1, 3 and 5 per cent. DDT in kaolin, applied to ripe tomatos artificially infested with *N. viridula*, gave complete mortality of adults and nymphs in all instars in 36–48 hours and most of the dusts were effective in 24 hours. Bugs of all stages that were caged on tomato plants that had been dusted with 5 per cent. DDT in kaolin suffered 64 per cent. mortality in a week, and one application of 1 per cent. DDT dust gave complete control on naturally infested tomatos and beans for a month and caused the bugs to leave the untreated plants in adjacent rows ; spraying tomato plants with 0·1 per cent. DDT had the same effect.

One application of the 0·1 per cent. DDT spray gave complete kill of *Aphis* (*Doralis*) *fabae*, Scop., on heavily infested broad beans ; it also seriously affected bees visiting the flowers while they were still wet. It gave at least 90 per cent. kill of *Anuraphis persicae-niger*, Smith, on heavily infested peach in a week and afforded sufficient protection to the trees until adverse weather killed the remaining Aphids and permitted the normal growth of new shoots. Early laboratory experiments with 5 per cent. DDT in kaolin indicated that this dust was effective against *Brevicoryne brassicae*, L., but in large-scale field tests on cabbage near Canberra, 0·5 and 1 per cent. dusts at 20 lb. per acre and sprays of 0·5 and 0·1 per cent. DDT at 80 gals. per acre did not give satisfactory control. Two applications of the 0·1 per cent. spray at the rate of 2 gals. per tree at an interval of one month were ineffective against *Eriosoma lanigerum*, Hsm., on apple. In laboratory tests, 5 per cent. DDT in kaolin gave complete mortality of *Myzus persicae*, Sulz., and *Macrosiphum solanifolii*, Ashm. (*gei*, auct.) in 48 hours, and a dust of DDT, talc and pyrophyllite (1 : 49 : 50) applied in early spring at the rate of 32 lb. per acre to lettuce heavily infested by these two Aphids gave 68 per cent. mortality at the end of two days and 88 per cent. at the end of a week ; no further treatment was required, and no plant injury resulted. In a large field test, dusts of 1 and 5 per cent. DDT in pyrophyllite, applied at 35 lb. per acre, gave complete control of *Myzus persicae* on late cabbage, and the 0·1 per cent. spray gave complete control of this Aphid on potato.

Two late sprays of 0·1 per cent. DDT applied to young peach trees in Victoria at the rate of about 2 gals. per tree on 6th and 21st February reduced the percentage of fruits infested by *Cydia molesta*, Busck, at harvest from 6·5 to 3·6. There was a DDT residue on the fruit of approximately 9 parts per million,

but analysis of canned fruit from the treated crop showed that it contained no DDT. In a small orchard test at Canberra, 0·1 per cent. DDT applied against *C. pomonella*, L., on pear, in a schedule comprising a petal-fall spray on 13th October and four cover sprays, reduced the percentage of fruits (including fallen ones) infested at harvest to 5, as compared with 100 in the controls. In a test against *C. pomonella* in Victoria, some trees in a block of pears that had received the ordinary lead-arsenate schedule until the end of December were sprayed with 0·1 per cent. DDT at the rate of about 2 gals. per tree on 6th February, when about 5 per cent. of the fruits was infested and eggs of the third generation were being deposited. This spray reduced the infestation from 10 to 8 per cent. on 19th February and from 25 to 10·5 per cent. on 26th February. A single spray of 0·05 or 0·1 per cent. DDT completely controlled *Caliroa limacina*, Retz., on one pear tree.

Several experiments were carried out against *Gnorimoschema operculella*, Zell. In laboratory tests, a dust of 5 per cent. DDT in kaolin, applied to the larvae, killed them all in 40–46 hours, and one of 1 per cent. DDT, applied to potato leaves, gave 83–85 per cent. mortality of adults caged with them for 72 hours. Sprays containing 0·1, 0·5, 1 and 2 per cent. DDT applied to newly hatched larvae on potato plugs caused average mortalities of 96·4, 91·8, 89·2 and 87·5 per cent., respectively, in nine days. In field tests in Queensland, sprays of 0·1 and 0·2 per cent. DDT, applied at the rate of 80 gals. per acre, both killed all the larvae on a severely infested egg-plant [*Solanum melongena*] in three days. The weaker spray applied at 110–120 gals. per acre near Canberra, gave greater yields of sound potatoes than 1 per cent. DDT dust at 40 lb. per acre or any other treatment [*cf.* next abstract]. This field was severely attacked by blight late in the season, so that no observations on the direct effect of DDT against *G. operculella* on the growing haulms could be made. Three applications of 0·5 per cent. DDT dust and 20 per cent. cryolite dust at the rate of 60 lb. per acre, made in New South Wales on 26th January, 22nd February and 19th March, resulted in average yields of 1·3 and 1·1 lb. sound potato tubers per plant, as compared with 0·9 lb. for no treatment, the percentages infested being 11, 9 and 9, respectively. It therefore appeared that DDT did not protect tubers in the ground. The ratings for damage to the haulms [*R.A.E.*, A **33** 93] averaged 0·68 and 0·82 on 22nd February, as compared with 0·92 for no treatment, and the increased yield of sound tubers due to the protection of the haulms was just significant for DDT but not for cryolite. In another field test, 1 per cent. DDT dust was applied at 30 lb. per acre in the third week of March to potatoes that had been treated about a month before with derris or cryolite. The percentage damage at harvest was 4·5 for derris alone, 0·8 for derris followed by DDT, 1·8 for cryolite alone, 0·4 for cryolite followed by DDT and 13·2 for no treatment. It is concluded that a 0·1 per cent. DDT spray at 110–120 gals. per acre or a 2 per cent. dust at 30–40 lb. per acre should give adequate control of *G. operculella* on the growing potato crop.

DDT dusts were effective against the larvae of several moths on cabbage in Queensland [**34** 231]. In tests near Canberra, 0·05 and 0·1 per cent. DDT sprays and 0·5 and 1 per cent. DDT dusts, applied twice at an interval of 12 days to a spring crop of cabbage maturing late in December, and at 80 gals. and 20 lb. per acre, respectively, at 10- or 14-day intervals to a late crop in February and March 1945 gave almost complete control of *Plutella maculipennis*, Curt., and were significantly better than a dust of 20 per cent. lead arsenate with 6 per cent. nicotine sulphate. The DDT sprays were significantly better than the dusts at either 10- or 14-day intervals. There was no significant difference between the same DDT dust applied at intervals of 10 or 14 days, but the stronger dust at 10-day intervals was significantly better than the weaker one at 14-day intervals. The stronger spray was significantly better than the weaker one at both intervals. The first application of any of the DDT treatments gave complete control of *Pieris rapae*, L., on both crops. Some nests of

Iridomyrmex detectus, F. Sm., were treated in October with 5 per cent. DDT dust at the rate of 1 oz. to every four entrance holes, others in December with 1 per cent. dust at 1 oz. to every five entrance holes, and one in January with 2 quarts emulsion containing 0·1 per cent. DDT, and all the colonies were completely controlled within one week of treatment, but in no case did the treatment prevent the repopulation of the nest sites by connected or neighbouring colonies. Dusts of 5 per cent. DDT, applied in cupboards against *Technomyrmex detorquens*, Wlk. (*albipes*, F. Sm.) and to a nest of this ant at Canberra, and on floors and in shallow tins round the legs of a refrigerator in Queensland against *Pheidole megacephala*, F., gave complete control.

A spray of 0·1 per cent. DDT was ineffective against the mite, *Tetranychus telarius*, L. (*urticae*, Koch) on bean plants in a greenhouse.

Entomological Investigations.—*19th Rep. Coun. sci. industr. Res. Aust. 1944–45* pp. 19–30. Canberra, 1945.

This report on work in Australia during the year ending 30th June 1945 includes a review of the methods adopted for the storage of wheat during the recent war and the measures developed to prevent and control its infestation by pests [*R.A.E.*, A **33** 318 ; **34** 121 ; etc.].

Chrysomela hyperici, Forst., *Agrilus hyperici*, Crtz., and *C. quadrigemina*, Suffr. (*gemellata*, Rossi), the insects introduced against St. John's wort (*Hypericum perforatum*), all made satisfactory progress during the year [*cf.* **33** 321]. A colony of *C. hyperici* established by the release of 10,000 adults in December 1943 in New South Wales was found to have survived, and a further 60,000 adults were liberated close by in December 1944. This species is exercising satisfactory control over considerable areas at three release sites in Victoria, and many landowners collected the insects and released them on their own properties ; colonies were released at two additional sites in November. Further consignments were sent to South Australia and released at two places. The colony of *C. quadrigemina* established in Victoria exercised considerable control in limited areas, and two collections were made, of which one, comprising 42,000 adults, was liberated in the same State on 25th November, and the other, comprising 50,000 adults, was sent to South Australia for release. Five consignments of these insects, comprising 2,020 adults of *A. hyperici*, 318 of *C. quadrigemina* and 8,600 of *C. hyperici*, were shipped to California during the year, and most arrived in good condition. *C. hyperici* appeared to be establishing itself in New Zealand [*cf.* **34** 323]. *Teleonemia scrupulosa*, Stål, which was introduced into Queensland against *Lantana camara*, continued to make better progress in the areas in the south-east [**33** 321], where it had previously been less satisfactory.

In tests with DDT, many of which have been noticed from another source [see preceding abstract], contact for one hour with surfaces treated with DDT at a rate of 50 mg. per sq. ft. gave 50 per cent. mortality of *Ctenolepisma urbana*, Slabaugh ; higher mortality was obtained by longer exposures or by exposure for shorter periods to a heavier deposit (up to 200 mg. per sq. ft.). Some of the insects remained moribund for 6–7 days at 80°F. and a relative humidity of 60 per cent. Dusts containing derris, DDT, 666 (benzene hexachloride), yam bean (*Pachyrrhizus strigosus*) and synthetic cryolite were all effective against larvae of *Gnorimoschema operculella*, Zell., in the laboratory, and in a field test on potatoes at Canberra, DDT dust was more effective than dusts of 666, phenothiazine, synthetic cryolite, derris or astringent lead arsenate, and a spray of DDT in solvent-naphtha emulsion was more effective than sprays of derris, synthetic cryolite or phenothiazine or the DDT dust. Sprays containing emulsions of crude 666 and a refined product from which all the α isomer and

half the β isomer had been removed [*cf.* **33** 256] gave excellent control of *Plutella maculipennis*, Curt., and *Brevicoryne brassicae*, L., on cabbage and were superior to a dust of 666 ; both 666 and DDT were greatly superior to a dust of lead arsenate and nicotine against *P. maculipennis*, and both controlled larvae of *Pieris rapae*, L., in all treatments. Tomato plants sprayed with DDT in solvent-naphtha emulsion in Queensland were effectively protected against *Empoasca fabae*, Harr., remained green longer than untreated plants and gave higher yields. In preliminary laboratory tests against *Chortoicetes terminifera*, Wlk., no serious infestation by which occurred during the year, locusts of various ages confined on a surface bearing a deposit of 100 mg. DDT per sq. ft. were all dead within a day or two. Dusts of 666 and DDT (10 per cent. in kaolin) applied to mounds of *Eutermes exitiosus*, Hill, in the usual manner at a rate of ½ oz. per mound were ineffective ; no dead termites were found 12 weeks after treatment with DDT and only a few near the site of application in the case of 666. In a comparative test of Paris green and white arsenic applied at a rate of ¼ oz. per mound, the four colonies treated with the latter were destroyed in 12 weeks, whereas mortality was complete in only one of the four treated with Paris green.

Work was continued on the biological control of *G. operculella* [*cf.* **33** 322]. Seven consignments of *Bracon* (*Microbracon*) *gelechiae*, Ashm., were introduced for mass rearing in the laboratory, and over 17,000 adults were released in South Australia, the Australian Capital Territory, New South Wales and Queensland. A further ten consignments of *Chelonus phthorimaeae*, Gah., were received from California, but, owing largely to delays in transit, only small stocks were obtained for rearing. Nearly 2,500 adults were released in New South Wales, the Capital Territory and South Australia, and recoveries were made in potato fields in the Capital Territory where liberations had been made in December 1943. *Apanteles glomeratus*, L., which was introduced against *Pieris rapae*, continued to maintain itself in the Capital Territory [*cf.* **33** 322]. *Comperiella bifasciata*, How., which had been liberated against *Aonidiella aurantii*, Mask., on *Citrus* was found to have survived in South Australia and New South Wales [*cf.* **33** 322]. Rearing of *Metaphycus helvolus*, Comp., for release against *Saissetia oleae*, Bern., was continued, further small liberations were made in New South Wales [*cf.* **33** 322], and there were indications that this parasite was maintaining itself at places in South Australia in which it had been released.

The survey of abundance of *Myzus persicae*, Sulz., and *Macrosiphum solanifolii*, Ashm. (*gei*, auct.), which transmit the leaf roll and mosaic diseases of potato [*Corium solani* and *Marmor solani* of Holmes], was continued at Canberra [**33** 323]. Populations were very small, except on irrigated lettuce, owing to drought, and no alates were recorded in mechanical nets during November–March. In April, a small generation appeared on potatoes and produced alates. The yellow dwarf disease of tobacco, which is transmitted by *Thamnotettix argentata*, Evans [*cf.* **31** 137], developed in 30 per cent. of the plants in a plot at Canberra, where tobacco had not been grown for some years.

Elsewhere in the report (p. 51), it is stated that overwintering larvae of *Tortrix postvittana*, Wlk., were readily found on leguminous cover crops among grape vines and on lucerne in the Murray Valley, Victoria, in early spring, but severe wind and dust storms destroyed part of the vines and possibly the adults and larvae as well, and it was difficult to find any stage of the moth in October. Some of the overwintering larvae were parasitised by the Tachinid, *Voriella uniseta*, Mall. Supplementary control measures, comprising the early destruction of cover crops harbouring the pest and spraying the leaves of the vines with lead arsenate, were carried out in experimental plots, but comparison with control areas indicated that they were not necessary in that particular season.

MICHELMORE (A. P. G.). **The Habits and Control of the Red Locust in Outbreak Areas and Elsewhere.**—*Bull. ent. Res.* **37** pt. 3 pp. 331–379, 49 refs. London, 1947.

The following is almost entirely taken from the summary of this paper, in which the measures used against *Nomadacris septemfasciata*, Serv., in the lake Rukwa outbreak centre (Tanganyika Territory) during 1942–45 and the habits of this locust that have a bearing on control are described, and the whole question of control methods is discussed in the light of the experience gained. Apart from the eggs, which are laid in the ground, and adult swarms of phase *gregaria*, which largely rest and feed on the foliage of trees, all stages of this locust prefer more or less tall and dense grass and seldom occur on the ground. It is more agile and wary, but less active, than some other locusts. Examples of phase *solitaria* are normally scattered in open grasslands, though the hoppers may be slightly gregarious. When numerous, the adults of this phase sometimes form sedentary concentrations in tall grass, especially in the latter part of the dry season, and these occasionally migrate a few miles at the beginning of the rainy season before breaking up. Whether isolated or in groups, the adults normally scatter widely for breeding at the onset of the rains. Hoppers of phase *transiens* in the outbreak areas live in small, loose bands, and the adults form small swarms, which remain mainly on tall grass and undertake only short and partial flights ; these swarms may break up during the dry season and usually do so when the rains begin, occasionally making a short migration first. After scattering, the adults adopt the habits of phase *solitaria*. Except during heavy outbreaks, the egg-pods even of phase *gregaria* are difficult to locate and are often scattered. In incipient outbreaks, the bands are usually composed of hoppers of various ages with young adults, and the largest ones found have occupied areas of about 550×200 yards. In large outbreaks, the bands commonly consist of hoppers of the same age and may be a mile or more across. At night the adults crowd densely together, in the dry season at least, on trees or, if no trees are present, in tall grass. In the morning, they scatter to some extent to feed on trees and ground vegetation and gradually become more active and take partial circling flights that may, as the day gets hot, develop into migratory flights, usually lasting until late in the day. After the swarm has settled for the night, further concentration takes place, often even after dark. Flight by night is rare, and the locusts do not usually fly when the temperature is low or the wind high. During the dry season, flying bands, which are usually in column formation, are low and compact, but with the onset of the rains they become diffuse and are often high. In incipient outbreaks, swarms with a maximum length of rather more than $4\frac{1}{4}$ miles when in flight and a maximum diameter of less than $\frac{1}{3}$ mile when concentrated at night have been observed. Large swarms generally break up into small ones for oviposition, which takes place at night.

The campaigns carried out in the rainy seasons of 1942–43 and 1943–44 were successful in destroying incipient outbreaks in the hopper stage, but the outbreak in 1944–45 was considerably more severe than had been anticipated. The campaign in that season was successful in Rukwa South and Rukwa West, but between 50 and 100 flying swarms developed in the central part of Rukwa North, although about half the population had been destroyed in the hopper stage and only numerous scattered locusts and one large sedentary swarm had been observed in the previous season. Of the measures adopted against the hoppers, beating [*cf. R.A.E.*, A **34** 280] and the use of arsenical baits and sprays gave excellent results, but sweeping with nets and burning with a ring of fire were seldom effective. Measures against the adult locusts were tested only in 1945, when beating, hand-collection and the use of arsenical baits were of doubtful value, and dusting with dinitro-ortho-cresol was ineffective. Various substances were used as carriers for sodium arsenite in the baits. Maize bran and the malt

and chaff of *Eleusine coracana* are especially recommended; meal from *E. coracana* and maize gave good results, but these are required for human consumption. Coffee parchment without molasses [*cf.* **34** 294] was unsuitable as it did not adhere to the grass. An aeroplane was effectively used in scouting for swarms, and aircraft are likely to be of value for the application of baits or dusts against them.

Recommendations based on the present study are given for the control of outbreaks in their various stages, and it is suggested that outbreak areas of *Nomadacris* might be rendered unfavourable for it by draining, flooding or the prevention of grass fires. Draining is, however, impracticable in both the known outbreak areas (Rukwa and Mweru wa Ntipa, Northern Rhodesia), and flooding is impossible in Rukwa. The prevention of grass fires is possible in both and is especially applicable to the flood plains of Rukwa North and West.

CALLAN (E. McC.). **Cotton Stainers (*Dysdercus* spp.) in the West Indies.**—*Bull. ent. Res.* **37** pt. 3 pp. 389–391, 8 refs. London, 1947.

Lists are given of the species of *Dysdercus* that occur in the West Indies, with information on their distribution and notes from the literature on the synonymy of some of them.

JACOB (F. H.). **An Account of a Black Aphid, *Doralis fabae* (Scop.) subsp. *armata* (Hausmann), found on *Digitalis purpurea*, L.**—*Bull. ent. Res.* **37** pt. 3 pp. 431–437, 1 fig., 13 refs. London, 1947.

Colonies of a black Aphid that was practically indistinguishable from *Aphis* (*Doralis*) *fabae*, Scop., were observed on foxglove (*Digitalis purpurea*) in mountainous districts in Westmorland, Cumberland, Caernarvonshire and Anglesey during 1942–46. The author reviews evidence suggesting that *A. fabae* exists in Britain in a number of forms differing in food-plants, morphology or both [*cf. R.A.E.*, A **35** 39], and considers that the Aphid on foxglove is a subspecies of *A. fabae* for which the name *armata*, Hsm., is available. Some features of its morphology are described, including characters distinguishing it from the typical *A. fabae* on broad beans and *Euonymus*, and an account is given of observations and experiments on its bionomics. These indicate that it occurs throughout the year on foxglove, on which the sexual forms are produced by apterous sexuparae, that its eggs on foxglove hatch rather later than those of *A. fabae* on *Euonymus* and that it will colonise *Rumex*, but not broad beans or beet, which are the typical summer food-plants of *A. fabae*, or *Cirsium*. Numerous eggs were transferred to *Euonymus* in the winter of 1943 and most of them hatched, but only one fundatrix survived and reproduced. Five of its progeny matured, and two were transferred to foxglove and thrived, while three were transferred to beans and died. The Aphids on foxglove were tended by various ants, a list of which is given, and were heavily parasitised at one locality by *Aphidius dissolutus*, Nees.

GOUGH (H. C.). **Studies on Wheat Bulb Fly, *Leptohylemyia coarctata*, Fall. II. Numbers in Relation to Crop Damage.**—*Bull. ent. Res.* **37** pt. 3 pp. 439–454, 1 fig., 19 refs. London, 1947.

The following is partly based on the author's summary of this second part of a paper [*cf. R.A.E.*, A **34** 367]. A detailed quantitative study of the incidence and development of attack by *Hylemyia* (*Leptohylemyia*) *coarctata*, Fall., in a wheat field in Yorkshire in 1944 is described. The numbers of larvae, puparia, plants and shoots and the percentages of plants and shoots attacked were estimated on various dates. Similar information was obtained from other fields in 1944 and 1945. No single factor could be correlated with the effect of

the attack on the crop. The numbers of larvae ranged up to nearly 600,000 per acre, but high numbers did not invariably result in a poor crop and a high percentage of infested plants or shoots was not necessarily associated with crop failure ; the number of shoots per plant at the time the larvae hatch was found to be important in this connection, and in some cases attack stimulated tillering.

A sampling technique for estimating the number of eggs present in the soil is described, and the results obtained from soil under different crops and from different localities in 1943 and 1944 are recorded. The number of eggs under a close crop of wheat or wheat and oats was negligible, but they were numerous in a field of oats in which there was a thick cover of weeds. The highest egg populations were in potato fields, though in 1944, when soil from under carrots was included in the samples, the difference between the number of eggs from these crops was barely significant. In general, however, the compact soil under potatoes appeared to be preferred to the light open soil under root crops, kale or savoys. It is concluded that oviposition was not reduced by a covering growth, provided that the soil near the ground was not densely covered. Soil differences may be an important factor in determining suitable sites. In 1943, over 7½ million eggs per acre were deposited in a potato field, but in autumn an unexplained reduction of about 90 per cent. had occurred ; about 2 million eggs were laid per acre in that district in the following year, but no large reduction occurred. The proportion of eggs that hatched and gave rise to larvae that successfully infested plants varied from 20 to 50 per cent. It is not considered likely that egg counts can be used for forecasting outbreaks.

The natural mortality that occurs among the different stages of *H. coarctata* is discussed. Equal numbers of males and females emerged in the laboratory. The adults are sometimes attacked by a fungus of the *Empusa* type, but it does not kill many even in wet seasons. The surviving females probably deposit about 30 eggs each, but many of these are laid in fields that are later cropped unsuitably or in which the proportion of potential food-plants is low. A fairly high proportion of field-collected eggs hatched in the laboratory in 1943, but about 25 per cent. of those collected in 1944 were considered to be non-viable, and about one-half of the rest did not hatch. Mortality among the larvae is at first low, but there is a reduction in their numbers ranging up to 70 per cent. between the time when they begin to move from shoot to shoot [**34** 368] and pupation. Predacious Dipterous larvae were occasionally found with the remains of larvae of *H. coarctata* within damaged shoots.

GRAY (R. A. H.), PEET (W. V.) & ROGERSON (J. P.). **Observations on the Chafer Grub Problem in the Lake District.**—*Bull. ent. Res.* **37** pt. 3 pp. 455–468, 1 pl., 5 figs., 9 refs. London, 1947.

The following is largely the authors' summary. *Anomala* (*Phyllopertha*) *horticola*, L., causes extensive deterioration of the fell grassland in the Lake District of England. The flight period of the adults occurs between the end of May and the end of June. Eggs are laid in the soil at a depth of about 2½ inches, but the depth varies according to the nature of the soil. They hatch in 27 to 30 days in the field. The larvae destroy the grass roots, and the composition of the grassland deteriorates owing to the colonisation of infested areas by weed growth. Damage is accentuated by the predatory activities of rooks. There is only one generation a year. The fully fed larvae descend to the subsoil towards the end of October to overwinter, the dormant stage continuing until April. A prepupal stage of short duration is followed by the pupal stage, which is reached towards the end of April or early May. The egg and hatching mechanism are described, and the rate of larval growth is indicated. The distribution of attack in the Lake District is given. Within an infested area, the larvae are often most numerous where the gradient increases.

Estimates of the population in one locality gave 113,520 per acre on the fell-side and 67,207 per acre on the level portion. The number per acre is lower when conditions are excessively wet or excessively dry. Most were found where birds were at work on the turf; there were more in dry friable soil than in moist soil and more in places bordering on bracken than in areas at a distance from it.

Control of the larvae by means of insecticides is impracticable owing to expense and the danger of poisoning sheep on the fells. Naphthalene [*cf. R.A.E.*, A **29** 110] gave considerable mortality when sprinkled beneath patches of infested turf, but salt and various fertilisers did not. Dressing with fertilisers, however, improved the condition of the turf and appeared to reduce damage. An autumn dressing of basic slag followed by a dressing of kainit in the ensuing May is recommended, and harrowing and reseeding of bared patches on the lower or more level ground are also advised.

POTTER (C.), TATTERSFIELD (F.) & GILLHAM (E. M.). **A Laboratory Comparison of the Toxicity as a Contact Poison of DDT with Nicotine, Derris Products and the Pyrethrins.**—*Bull. ent. Res.* **37** pt. 3 pp. 469–496, 6 figs., 5 refs. London, 1947.

The toxicity of DDT at various concentrations as a contact poison to various insects was tested under standard conditions in the laboratory and compared with that of other commonly used contact insecticides. The apparatus and general procedure adopted have been described in a previous paper [*R.A.E.*, A **29** 591]. The medium generally employed by the authors in comparative tests of insecticides is a water solution containing 0·1 per cent. w/v sulphonated lorol and 10 per cent. v/v acetone, but DDT at the higher concentrations was rapidly precipitated out of this medium, and the one finally adopted for it was a water solution containing 0·1 per cent. w/v sulphonated lorol T.A., 1·5 per cent. v/v carbitol [diethylene glycol monoethyl ether] and 0·5 per cent. v/v acetone [*cf.* next abstract].

The following is based on the authors' summary. DDT, nicotine and a derris or rotenone suspension were tested against *Myzus cerasi*, F., adults of *Phaedon cochleariae*, F., and larvae of *Pieris brassicae*, L., *Nematus* (*Pteronus*) *ribesii*, Scop., and *Phymatocera aterrima*, Klug. A pyrethrin spray was also tested against the last three, and DDT and nicotine were tested against *Aphis fabae*, Scop., and *Operophtera* (*Cheimatobia*) *brumata*, L. Estimated on a basis of equal content of toxic ingredient, DDT was more toxic than nicotine to all the insects except the Aphids. It appeared to be about as toxic to *A. fabae* and about twice as toxic to *M. cerasi* as nicotine, but the slowness of its action and the amount of reproduction that occurred among the treated Aphids make it likely to be of less value in practice. It was much less toxic than rotenone to *M. cerasi*, *Phaedon* and the sawfly larvae, but more so to *Pieris*; complete mortality of the latter was given by DDT on derris resin at a concentration of 0·1 per cent. w/v in carbitol medium, whereas pure rotenone at the same concentration in acetone medium gave only 66 per cent. mortality. The pyrethrins were more toxic, weight for weight, than DDT to the three species against which they were tested. Rotenone appeared to be more toxic to *Phaedon* in acetone medium than in carbitol medium, but there was no significant difference between pyrethrins in these media tested against *Pieris*.

TATTERSFIELD (F.), POTTER (C.) & GILLHAM (E. M.). **The Effect of Medium on the Toxicity of DDT to Aphids.**—*Bull. ent. Res.* **37** pt. 3 pp. 497–502, 1 fig., 5 refs. London, 1947.

A suggestion that the toxicity of DDT to Aphids may be influenced by the medium in which it is incorporated was confirmed by experiments described, in which DDT in solution in benzene applied as an emulsion was 4–6 times as

toxic to *Macrosiphum solanifolii*, Ashm., as it was in suspension in the aqueous solution containing 1·5 per cent. v/v carbitol [diethylene glycol monoethyl ether], 0·1 per cent. w/v sulphonated lorol T.A. and 0·5 per cent. v/v acetone [*cf.* preceding abstract]. The stock for the emulsion consisted of 5 gm. DDT, 15 gm. benzene and 1 gm. anhydrous dodecyl sulphate. A series of tests with DDT at concentrations of 0·0125–0·1 per cent. w/v in the carbitol medium showed that, in general, more consistent results were obtained when the Aphids were examined on the third day after the treatment than on the second, and that Aphids sprayed with all concentrations were able to reproduce. A concentration of 0·1 per cent. was sometimes less toxic than one of 0·075 or even 0·05 per cent., apparently owing to aggregation or increase of particle size after the dilution of the concentrate.

Without DDT, neither the carbitol medium nor the benzene medium at a concentration corresponding to 0·1 per cent. DDT was materially toxic to *M. solanifolii*. This Aphid was selected for the main experiments because preliminary ones showed that *M.* (*Macrosiphoniella*) *sanborni*, Gill., and *Myzus circumflexus*, Buckt., were too susceptible to the carbitol medium to be of value as test insects. In a subsidiary test of constituents of certain basal media on *Macrosiphum sanborni*, the sodium salt of sulphonated lorol was more toxic than sulphonated lorol T. A.

Arruda (S. C.). **As doenças da cana de açucar no Estado de São Paulo.** [Diseases of Sugar-cane in the State of São Paulo.]—*Biológico* **11** no. 12 pp. 309–315, 4 figs., **12** nos. 1, 3, 5, pp. 21–27, 3 figs., 1 ref., pp. 63–69, 2 pls., pp. 123–134, 5 figs. São Paulo, 1945–46.

The second part of this paper on diseases of sugar-cane in the State of São Paulo, Brazil, contains notes on the symptoms and mode of spread of the virus of sugar-cane mosaic [*Marmor sacchari* of Holmes]. The virus is transmitted by various Aphids, of which *Aphis maidis*, Fitch, is the most efficient, but this Aphid is primarily a pest of maize. It is common on maize in summer in São Paulo, but has not been found on sugar-cane there, and *A. sacchari*, Zhnt., which is common on sugar-cane in winter, is not known to transmit the virus.

Lepage (H. S.), Giannotti (O.) & Pereira (H. F.). **Técnica para o ensáio de inseticidas residuais.** [A Technique for testing residual Insecticides.]—*Biológico* **11** no. 12 pp. 320–325, 3 figs., 1 ref. São Paulo, 1945.

At the conclusion of this account of laboratory tests of the toxicity to house-flies of deposits of 666 [benzene hexachloride] and DDT [*R.A.E.*, B **35** 70], it is stated that although deposits of 666 lose toxicity during exposure to light and air, this need not preclude its successful use as an agricultural insecticide. In preliminary tests against *Ceratitis capitata*, Wied., it was toxic after a shorter period of contact than was DDT.

Burgess (P. S.) & Hawkins (R. S.). **Fifty-fifth annual Report (Arizona Agricultural Experiment Station) for the Year ending June 30, 1944.**—100 pp., illus., 2 refs. Tucson, Ariz., 1945.

In a section on Entomology and Economic Zoology (pp. 50–51), it is stated that *Vasates* (*Phyllocoptes*) *destructor*, Keifer, was first observed in Arizona in the autumn of 1943 and severely damaged tomatos in the Santa Cruz and Salt River valleys in the following summer. *Melittia satyriniformis*, Hb., caused much injury to summer squash in the Tucson area in 1943 and 1944, and *Pycnoderes quadrimaculatus*, Guér., destroyed green beans over an area of ½ acre in the same district in 1943. *Papilio cresphontes*, Cram., was

unusually abundant on *Citrus* in the late summer of 1943, and *Leptoglossus zonatus*, Dall., which disseminates heart rot of pomegranate [caused by *Nematospora coryli*] was numerous on *Citrus* and pomegranate during the autumn.

Work on the necrosis of giant cactus [*Carnegiea gigantea*] caused by *Erwinia carnegieana* is briefly described in a section on Plant Pathology (pp. 75–83, 4 figs.). Most of the diseased plants dissected during January–February were found to have been extensively tunnelled by an insect; *E. carnegieana* was repeatedly isolated from the tunnels and disease lesions were associated with many of them. In March, larvae of *Cactobrosis fernaldialis*, Hulst, were collected from the tunnels and the bacterium was found to be present on their bodies and within their intestines. It was also later isolated from the adults and from their eggs.

Birch (L. C.). **The Influence of Food on the Size of two Strains of *Calandra oryzae* L.**—*Aust. J. exp. Biol. med. Sci.* **24** pt. 2 pp. 123–125, 1 fig., 5 refs. Adelaide, 1946.

Adults of *Calandra oryzae*, L., collected from maize in Queensland and northern New South Wales were found to have mean lengths (elytra and pronotum) of 3·2 and 3·3 mm., respectively, which are significantly greater than the mean length (2·9 mm.) of the large strain that had been breeding for several generations in wheat [*cf. R.A.E.*, A **34** 21–22]. Adults from maize in Sydney had a length of 2·7 mm., which is significantly greater than that of the small strain (2·5 mm.) when bred in wheat for several generations, but significantly smaller than that of the large strain bred in wheat. Experiments were therefore carried out to find whether these insects represented further strains of *C. oryzae* or whether the differences in size were due to their having been bred in maize instead of wheat.

Crosses made after the insects had been bred on wheat for one generation showed that the Queensland insects were inter-fertile with the large strain, but not with the small one or the Sydney insects, which suggested that the Queensland and Sydney insects belonged to the large and small strains, respectively, and had become larger by breeding in maize. After breeding in wheat for seven generations, the Queensland insects were reduced in length to 2·84 mm., whereas the large strain bred in maize for the same period had increased its length to 3·23 mm., confirming the identity in size of these two lots. The size of the small strain after seven generations in maize was significantly smaller than that of the large strain bred in wheat, but about the same as that of the Sydney insects after they had bred in wheat for one generation. The change in size in one generation usually proved to be about the same as the total effect of seven generations. The change in size due to change of food was relatively the same in both strains.

Papers noticed by Title only.

Domínguez García-Tejero (F.). **Las plagas de los frutales en España y su distribución geográfica. II. Coleópteros y Dípteros.** [The Pests of Fruit Trees in Spain and their geographical Distribution. II. Coleoptera and Diptera.]—*Bol. Pat. veg. Ent. agríc.* **13** (1944) pp. 429–446, 16 figs., 20 refs. Madrid, 1945. [*Cf. R.A.E.*, A **34** 269.]

Nesbitt (H. H. J.). **A Revision of the Family Acaridae (Tyroglyphidae), Order Acari, based on comparative morphological Studies. Part I. Historical, morphological, and general taxonomic Studies.**—*Canad. J. Res.* (D) **23** no. 6 pp. 139–188, 55 figs., 52 refs. Ottawa, 1945.

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